Thermo SCIENTIFIC

Dionex ICS-1600 Ion Chromatography System Operator's Manual

Document No. 065290
Revision 03
October 2012

© 2012 by Thermo Fisher Scientific Inc. All rights reserved.

AES, AMMS ICE, ASRS, Chromeleon, Dionex, IonPac, OnGuard, and SRS are registered trademarks of Thermo Fisher Scientific Inc. in the United States.

Microsoft, Windows, Windows 2000, and Windows XP are registered trademarks of Microsoft Corporation in the United States and other countries. Adobe, Acrobat, and Adobe Reader are registered trademarks of Adobe Systems, Incorporated in the United States and other countries.

Reagent-Free and RFIC are trademarks of Thermo Fisher Scientific Inc.

PEEK is a trademark of Victrex PLC.

All other trademarks are the property of Thermo Fisher Scientific Inc. and its subsidiaries.

Thermo Fisher Scientific Inc. provides this document to its customers with a product purchase to use in the product operation. This document is copyright protected and any reproduction of the whole or any part of this document is strictly prohibited, except with the written authorization of Thermo Fisher Scientific Inc.

The contents of this document are subject to change without notice. All technical information in this document is for reference purposes only. System configurations and specifications in this document supersede all previous information received by the purchaser.

Thermo Fisher Scientific Inc. makes no representations that this document is complete, accurate or error-free and assumes no responsibility and will not be liable for any errors, omissions, damage or loss that might result from any use of this document, even if the information in the document is followed properly.

This document is not part of any sales contract between Thermo Fisher Scientific Inc. and a purchaser. This document shall in no way govern or modify any Terms and Conditions of Sale, which Terms and Conditions of Sale shall govern all conflicting information between the two documents.

Revision history: Revision 01 released March 2009; initial release of system
Revision 02 released December 2011; Thermo Fisher Scientific transition
Revision 03 released October 2012; new part numbers assigned

For Research Use Only. Not for use in diagnostic procedures.

Contents

1 • Introduction 1

1.1 Introduction to Ion Chromatography (IC) 1

1.2 Overview of the Dionex ICS-1600 4

1.3 About This Manual 5

1.3.1 Safety Messages and Notes 6

1.4 Safety and Regulatory Information 8

1.4.1 Safety Labels 8

2 • Features 11

2.1 Operating Features 11

2.1.1 Front Panel 11

2.1.2 Top Cover 15

2.1.3 Component Panel 16

2.1.4 Right-Side Panel 19

2.1.5 Rear Panel 20

2.2 Flow Schematics 22

2.3 Chromeleon and Chromeleon Xpress 26

2.3.1 The Panel Tabset 26

2.3.2 Software Control Modes 27

2.3.3 System Wellness 27

2.4 System Component Details 28
2.4.1 Vacuum Degas Assembly (Optional) 28
2.4.2 Eluent Valve 30
2.4.3 Pump 30
2.4.4 Injection Valve 32
2.4.5 Auxiliary Valve (Optional) 34
2.4.6 Column Heater 35
2.4.7 Suppressor 36
2.4.8 DS6 Heated Conductivity Cell 36
2.4.9 ER Controller 37

3 • Operation and Maintenance 39

3.1 Operation Overview 39
3.2 Turning On the System Power 41
3.3 Connecting to Chromeleon 42
3.4 Set Up the Eluent Reservoir 44
3.4.1 Prepare the Eluent 44
3.4.2 Degas the Eluent 44
3.4.3 Filter the Eluent 45
3.4.4 Fill the Reservoir 45
3.4.5 Set the Eluent Level 45
3.4.6 Connect the Reservoir 47
3.5 Check All Connections 47
3.6 Prime the Pump 47

3.7 Set System Operating Conditions 48
3.8 Equilibrate the System and Verify Operational Status 49
3.9 Prepare Samples 50
3.9.1 Collecting and Storing Samples 50
3.9.2 Pretreating Samples 51
3.9.3 Diluting Samples 51
3.10 Loading and Injecting Samples 52
3.10.1 Loading Samples with a Syringe 53
3.10.2 Loading Samples with a Vacuum Syringe 54
3.10.3 Loading Samples with an Autosampler 54
3.10.4 Injecting Samples 55
3.11 Processing Samples 55
3.11.1 Manual Sample Processing 55
3.11.2 Automatic (Batch) Sample Processing 56
3.12 Maintenance 58

4 • Troubleshooting 61

4.1 Error Messages 61
4.2 Troubleshooting Error Messages 63
4.3 Liquid Leaks 71
4.4 Pump Difficult to Prime or Loses Prime 73
4.5 Pump Does Not Start 75
4.6 No Flow 75
4.7 Erratic Flow/Pressure Reading 76

4.8 Excessive System Backpressure 77
4.9 Peak “Ghosting” 78
4.10 Nonreproducible Peak Height or Retention Time 79
4.11 Abnormal Retention Time or Selectivity 79
4.12 No Cell Response 79
4.13 High Cell Output 80
4.14 Baseline Noise or Drift 81
4.15 Vacuum Degas Assembly Does Not Run 82

5 • Service 85

5.1 Diagnostic and Calibration Procedures 85
5.1.1 Chromeleon Wellness Panel Overview 86
5.1.2 Diagnostic and Calibration Touch Screen Overview 88
5.1.3 Calibrating the Conductivity Cell 89
5.1.4 Calibrating the Flow Rate 92
5.1.5 Calibrating the Vacuum Degas Assembly 94
5.2 Isolating a Restriction in the Liquid Lines 95
5.3 Replacing Tubing and Fittings 98
5.4 Rebuilding the Injection Valve or Auxiliary Valve 99
5.5 Replacing an Auxiliary Valve Pod 100
5.6 Cleaning and Replacing the Pump Check Valves 103
5.7 Replacing a Pump Piston Seal and Piston Rinse Seal 105
5.8 Replacing a Pump Piston 109
5.9 Replacing the Waste Valve or Priming Valve O-Ring 110

5.10 Replacing the Conductivity Cell 112
5.11 Replacing the Suppressor 115
5.12 Replacing the Column Heater 116
5.13 Replacing the Column Heater Heat Exchanger 119
5.14 Replacing the Eluent Valve 120
5.15 Replacing the Leak Sensor 122
5.16 Priming the Pump 123
5.16.1 Priming the Eluent Lines with a Syringe 123
5.16.2 Priming with the Prime Button 125
5.17 Priming the Pump with Isopropyl Alcohol 126
5.18 Changing Main Power Fuses 127

A • Specifications 129

A.1 Electrical 129
A.2 Physical 129
A.3 Environmental 130
A.4 Front Panel 130
A.5 Analytical Pump and Fluidics 130
A.6 Eluent Regeneration 132
A.7 Detector Electronics 132
A.8 Conductivity Cell with Heat Exchanger 133
A.9 Injection Valve 133
A.10 Auxiliary Valve (Optional) 134
A.11 Vacuum Degas Assembly (Optional) 134

A.12 Column Heater 134
A.13 Suppressors 135
A.14 Autosampler 136
A.15 System Software 136

B • Touch Screen Operation 139

B.1 Using the Touch Screen 139
B.2 Using the Touch Screen with Chromeleon 142
B.3 Overview of Dionex ICS-1600 Touch Screen Pages 143
B.4 Home Page 144
B.4.1 Home Page Pump Controls 144
B.4.2 Home Page Column Heater 145
B.4.3 Home Page Injection Valve Controls 146
B.4.4 Home Page Detector Controls 146
B.4.5 Other Home Page Controls 147
B.5 Plot Page 148
B.6 Status Page 149
B.6.1 Viewing Other Status Parameters 151
B.6.2 Status Parameter Details 152
B.7 Pump Page 153
B.7.1 Setting Pump Pressure Limits and Selecting the Pressure Unit 153
B.7.2 Setting Degas Operating Parameters (Optional) 154
B.7.3 Controlling the Eluent Valve 155

B.8 Suppressor Page 156
B.9 Detector Page 157
B.9.1 Setting the Data Rise Time 158
B.9.2 Selecting the Conductivity Polarity 158
B.9.3 Setting Analog Out Options 159
B.10 Information Page 160
B.11 Module Setup Page 161
B.12 Input/Output Page 162
B.13 Diagnostic and Calibration Pages 162

C • TTL and Relay Control 165

C.1 TTL and Relay Connections 165
C.1.1 Selecting TTL Input Functions and Control Types 168
C.2 Controlling TTL and Relay Outputs 171
C.3 Example Setup for Stand-Alone Operation 172

D • Reordering Information 177

E • FAQ 181

E.1 How do I hook up an autosampler? 181
E.2 How do I print? 181
E.3 Why are the retention times moving? 181
E.4 How do I adjust retention times? 181
E.5 When should I remake standards? 181

E.6 When should I remake eluents? 182
E.7 How do I start Chromeleon? 182
E.8 How do I delete data? 182
E.9 How do I back up data? 182
E.10 How do I shut off the system? 182
E.11 How do I store columns? 182
E.12 How do I know when a column is dirty? 182
E.13 How do I clean a column? 183
E.14 Why is the conductivity high? 183
E.15 How do I configure and operate the auxiliary valve? 183

F • Glossary 185

Index

1 • Introduction

1.1 Introduction to Ion Chromatography (IC)

The Thermo Scientific Dionex™ ICS-1600 Ion Chromatography System (Dionex ICS-1600) performs ion analyses using suppressed or non-suppressed conductivity detection. An ion chromatography system typically consists of a liquid eluent, a high-pressure pump, a sample injector, a guard and separator column, a chemical suppressor, a conductivity cell, and a data collection system.

Before running a sample, the ion chromatography system is calibrated using a standard solution. By comparing the data obtained from a sample to that obtained from the known standard, sample ions can be identified and quantitated. The data collection system, typically a computer running chromatography software, produces a chromatogram (a plot of the detector output vs. time). The chromatography software converts each peak in the chromatogram to a sample concentration and produces a printout of the results.

A typical IC analysis consists of six stages (see Figure 1-1).

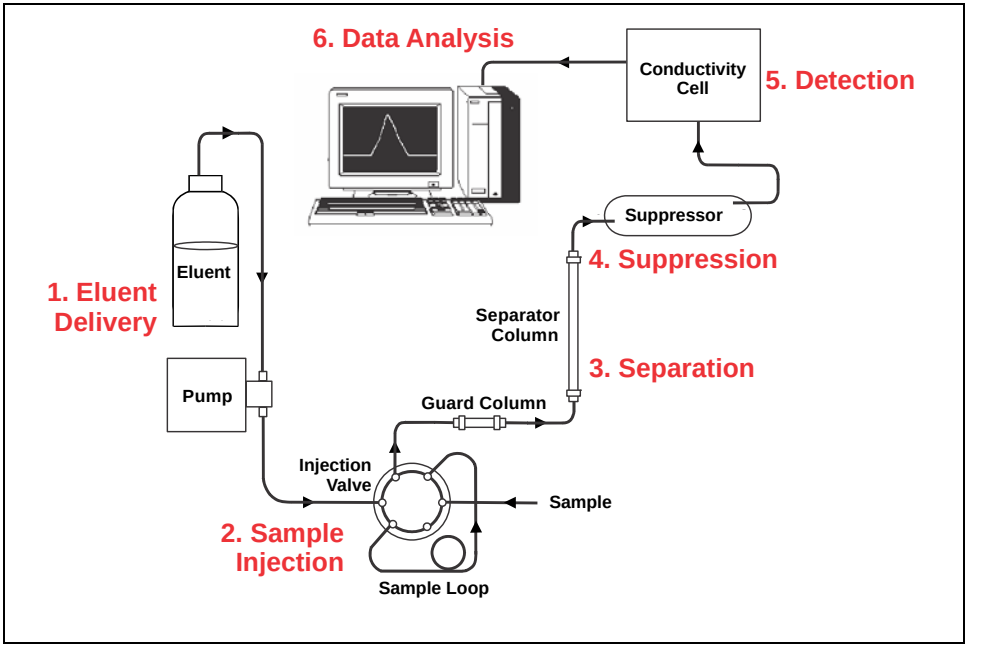


Figure 1-1. Ion Analysis Process

1. Eluent Delivery

- Eluent, a liquid that helps to separate the sample ions, carries the sample through the ion chromatography system. The Dionex ICS-1600 is an isocratic delivery system. This means that the eluent composition and concentration remain constant throughout the run.

2. Sample Injection

- The liquid sample is loaded into a sample loop either manually or automatically (if an automated sampler is installed). When triggered, the Dionex ICS-1600 injects the sample into the eluent stream.
- The pump pushes the eluent and sample through the guard and separator columns (chemically-inert tubes packed with a polymeric resin). The guard column removes contaminants that might poison the separator column.

3. **Separation**

   - As the eluent and sample are pumped through the separator column, the sample ions are separated. In the Dionex ICS-1600, the mode of separation is called ion exchange. This is based on the premise that different sample ions migrate through the IC column at different rates, depending upon their interactions with the ion exchange sites.

4. **Suppression**

   - After the eluent and sample ions leave the column, they flow through a suppressor that selectively enhances detection of the sample ions while suppressing the conductivity of the eluent.

5. **Detection**

   - A conductivity cell measures the electrical conductance of the sample ions as they emerge from the suppressor and produces a signal based on a chemical or physical property of the analyte.

6. **Data Analysis**

   - The conductivity cell transmits the signal to a data collection system.
   - The data collection system (for the Dionex ICS-1600, this is the Chromeleon™ Chromatography Management System) identifies the ions based on retention time, and quantifies each analyte by integrating the peak area or peak height. The data is quantitated by comparing the sample peaks in a chromatogram to those produced from a standard solution. The results are displayed as a chromatogram and the concentrations of ionic analytes can be automatically determined and tabulated.

1.2 Overview of the Dionex ICS-1600

The Dionex ICS-1600 is an integrated ion chromatography system containing a pump, injection valve, column heater, and conductivity detector. Other system components, including a guard column, separator column, and suppressor vary, depending on the analyses to be performed.

The Dionex ICS-1600 can optionally be configured with a vacuum degas assembly for online eluent degassing. An optional second high-pressure valve (6-port or 10-port) can be installed for sample preparation applications.

The Dionex ICS-1600 contains a built-in ER Controller and pre-plumbed tubing for operation in the RFIC-ER™ (Reagent-Free™ Ion Chromatography with Eluent Regeneration) mode. RFIC-ER technology uses the suppressor to regenerate returning eluent, allowing a single batch of eluent to be used for up to four weeks.

Dionex ICS-1600 operation can be controlled in one of two ways:

- *Remotely*, with a personal computer running Microsoft® Windows® Vista or Windows XP and Chromeleon software (version 6.80 SR6a or later). Chromeleon also provides data acquisition and data processing functions.
- *Locally*, with the front panel LCD touch screen. The touch screen is used for instrument control only. It does not provide data acquisition or data processing functions. An analog output on the rear panel can be connected to a separate data acquisition device.

For communication between the Dionex ICS-1600 and Chromeleon, the Dionex ICS-1600 is connected to a USB (Universal Serial Bus) port on the computer or a USB hub. For details, see the Dionex ICS-1600 installation instructions. Also refer to *Installing the Chromeleon Chromatography Management System with a Dionex Ion Chromatograph (IC)* (Document No. 031883).

1.3 About This Manual

The electronic version (i.e., PDF file) of this operator's manual contains numerous hypertext links that can take you to other locations within the file. These links include:

- Table of contents entries
- Index entries
- Cross-references (underlined in blue) to sections, figures, tables, etc.

If you are not familiar with how to navigate PDF files, refer to the Help system for Adobe® Acrobat® or Adobe Reader® for assistance

Chapter 1 Introduction	Introduces ion analysis and the Dionex ICS-1600; explains the conventions used in this manual, including safety-related information.
Chapter 2 Features	Provides an overview of Dionex ICS-1600 operating features and system components; introduces the Chromeleon user interface.
Chapter 3 Operation and Maintenance	Provides operating instructions and describes routine preventive maintenance procedures.
Chapter 4 Troubleshooting	Lists problems, and presents step-by-step procedures for how to isolate and eliminate the cause of each problem.
Chapter 5 Service	Provides step-by-step instructions for routine service and parts replacement procedures that the user can perform.
Appendix A Specifications	Lists the Dionex ICS-1600 specifications and installation site requirements.
Appendix B Touch Screen Operation	Describes the operating features available from the front panel touch screen.
Appendix C TTL and Relay Control	Describes the Dionex ICS-1600 TTL and relay control features.
Appendix D Reordering Information	Lists spare parts for the Dionex ICS-1600.

Appendix E FAQ	Provides answers to frequently asked questions about Dionex ICS-1600 operation.
Appendix F Glossary	Defines terms commonly used in ion analysis.

1.3.1 Safety Messages and Notes

This manual contains warnings and precautionary statements that, when properly followed, can prevent personal injury and/or damage to the instrument. Safety messages appear in bold type and are accompanied by icons, as shown below.

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Also used to identify a situation or practice that may seriously damage the instrument, but will not cause injury.

Indicates that the function or process of the instrument may be impaired. Operation does not constitute a hazard.

Messages d'avertissement en français

Signale une situation de danger immédiat qui, si elle n'est pas évitée, entraînera des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures mineures à modérées. Également utilisé pour signaler une situation ou une pratique qui pourrait gravement endommager l'instrument mais qui n'entraînera pas de blessures.

Warnhinweise in Deutsch

Bedeutet unmittelbare Gefahr. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

Bedeutet eine mögliche Gefährdung. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

Bedeutet eine mögliche Gefährdung. Mißachtung kann zu kleineren oder mittelschweren Verletzungen führen. Wird auch verwendet, wenn eine Situation zu schweren Schäden am Gerät führen kann, jedoch keine Verletzungsgefahr besteht.

Notes

Informational messages also appear throughout this manual. These are labeled NOTE and are in bold type:

NOTE NOTES call attention to certain information. They alert you to an unexpected result of an action, suggest how to optimize instrument performance, etc.

1.4 Safety and Regulatory Information

The Dionex ICS-1600 was manufactured by Thermo Fisher Scientific at the following location: 527 Lakeside Drive, Sunnyvale, CA 94088-3603 U.S.A. The Dionex ICS-1600 is designed for IC (ion chromatography) applications and should not be used for any other purpose. Operation of a Dionex ICS-1600 in a manner not specified by Thermo Fisher Scientific may result in personal injury. If there is a question regarding appropriate usage, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

1.4.1 Safety Labels

The TUV T-Mark and cTUVus Mark safety labels and the CE Mark label on the system indicate that it is in compliance with the following standards:

EMC Susceptibility and Emissions

- EN 61326-1:2006

Safety

- CAN/CSA-C22.2 61010-1:2004
- UL 61010-1:2004
- EN 61010-1:2001

The symbols below appear on the Dionex ICS-1600 or on labels affixed to the Dionex ICS-1600.

Alternating current

Primary protective conductor terminal

Secondary protective conductor terminal

Power supply is on

Power supply is off

Hot surface

Indicates a potential hazard. Refer to the operator's manual for an explanation of the hazard and how to proceed.

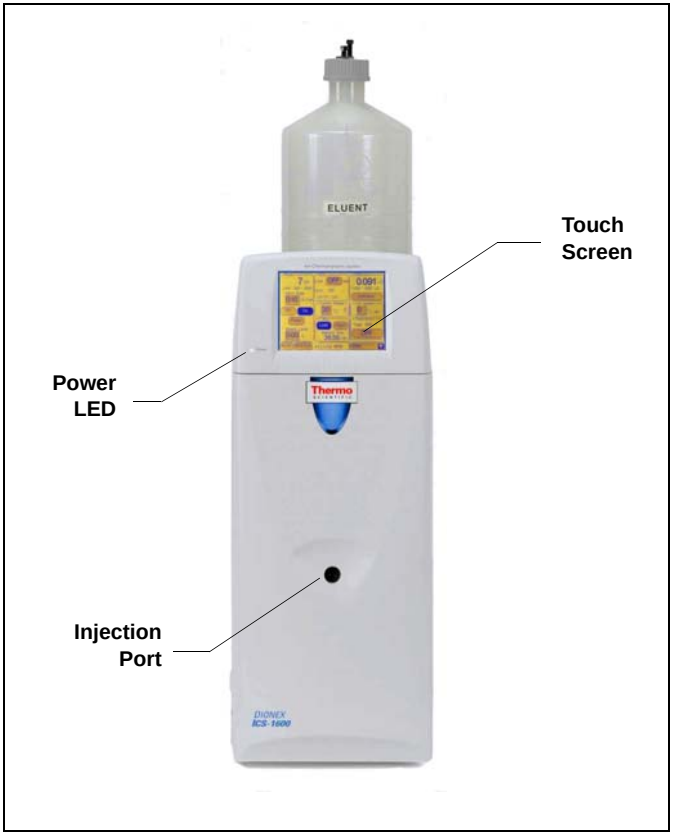
2 • Features

This chapter describes key Dionex ICS-1600 features and introduces the Chromeleon user interface.

2.1 Operating Features

2.1.1 Front Panel

Figure 2-1 illustrates the front panel of the Dionex ICS-1600.



Injection Port

The sample to be analyzed can be injected manually into the injection port, using a syringe. For automated sample injection, the Dionex ICS-1600 must be connected to an autosampler. For more information about sample injection, see Section 3.10.

Touch Screen

The LCD touch screen provides local control of most Dionex ICS-1600 functions. You can control many of these functions directly on the touch screen's **HOME** page (see Figure 2-2). From the **HOME** page, you can also go to a series of pages that provide access to all other locally controlled Dionex ICS-1600 operating functions.

Figure 2-1. Dionex ICS-1600 Front Panel

Summary of Touch Screen Operation

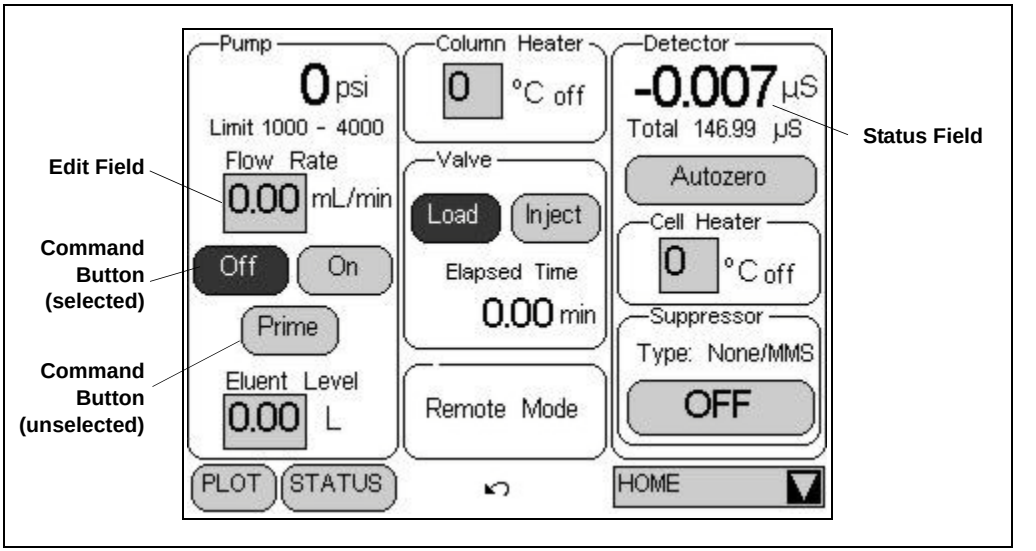


Figure 2-2. Dionex ICS-1600 Touch Screen Home Page

NOTE To adjust the screen contrast, open the front door and adjust the knurled knob under the screen (see Figure 2-8).

- Edit fields and command buttons have blue text on a shaded background. Fields that display status information are not shaded.
- Edit fields have square corners, while command buttons are rounded.
- To select a command button or edit a field, touch and release the command button or edit field with your fingertip.

NOTE When you touch a button or edit field, the action is taken when you lift your finger. If you unintentionally touch a button or field, you can cancel the action by sliding your finger away from the button or field before lifting.

- Touching a command button (for example, Inject) executes the command immediately.

- Selecting a command button changes the button's appearance to white text on a dark backgound (for example, Inject).
- Touching an edit field (for example, Flow Rate 0.00 mL/min) opens a page with a number keypad (see Figure 2-3). Use the keypad to enter the desired numerical value for the field and then touch the **ENTER** button.

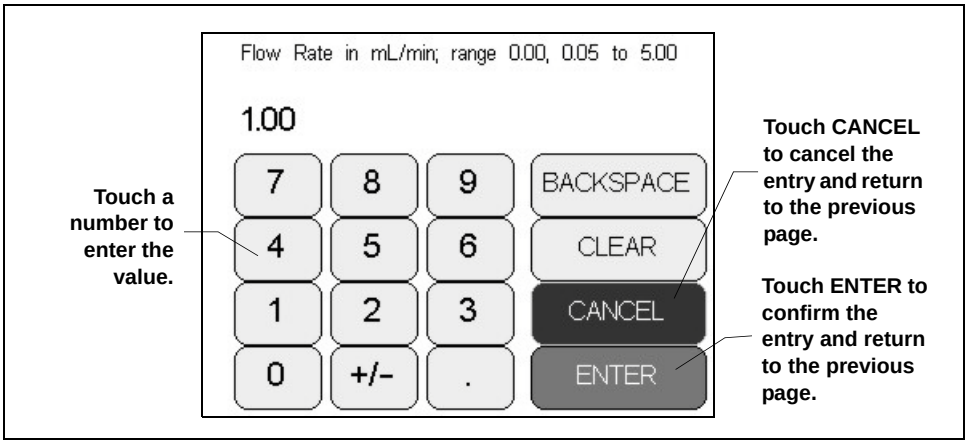


Figure 2-3. Number Keypad

- Touching the page name (for example, HOME) in the bottom right corner opens a menu of pages (see Figure 2-4).

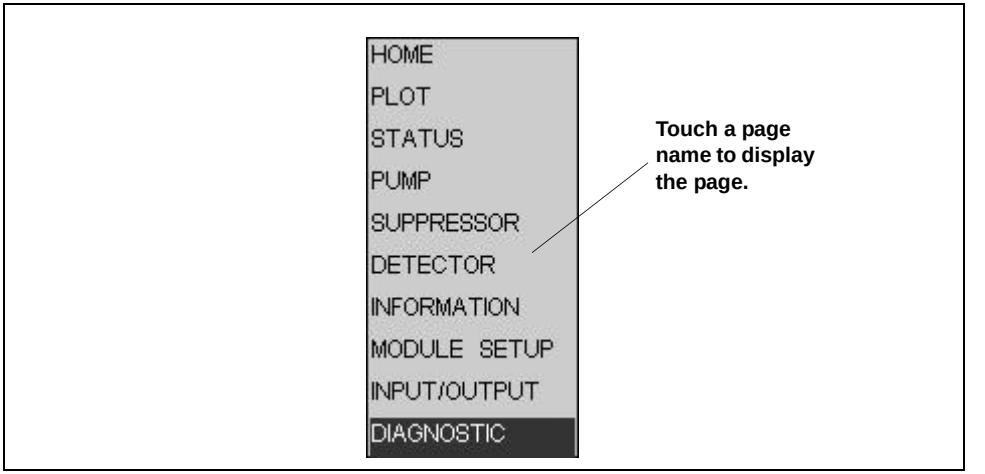


Figure 2-4. Dionex ICS-1600 Touch Screen Menu of Pages

- Touching a page name on the menu of pages displays the selected page. For example, touching **SUPPRESSOR** displays the **SUPPRESSOR** page (see Figure 2-5). See Appendix B for details about each touch screen page.

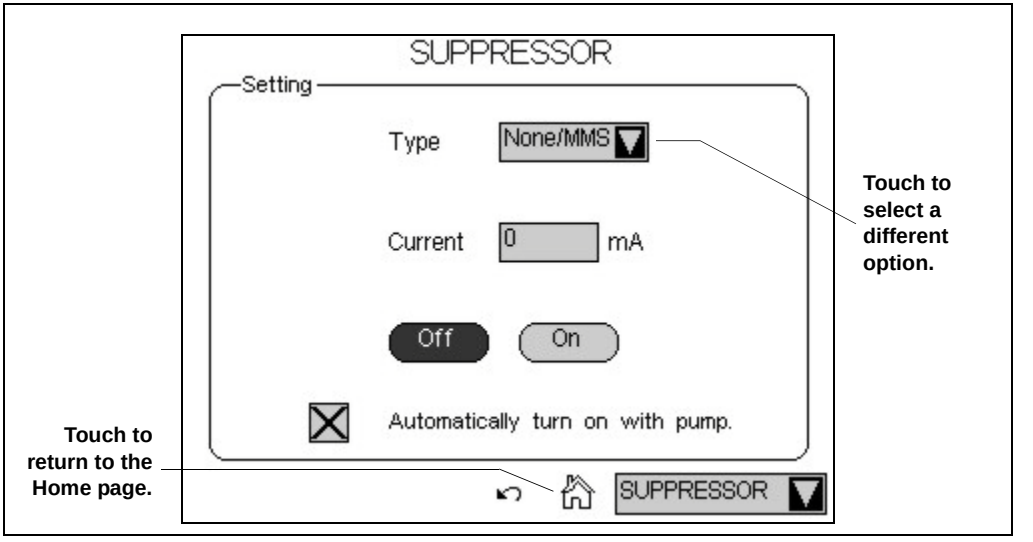


Figure 2-5. Suppressor Page

- Touching returns you to the **HOME** page.
- Touching opens a list of options (see Figure 2-6).

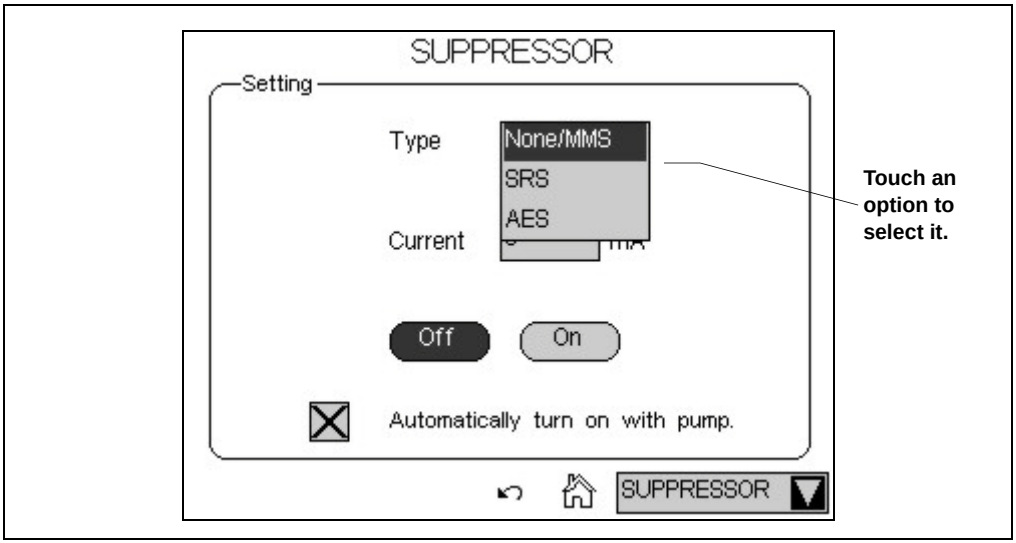


Figure 2-6. Suppressor Page: Selecting an Option

2.1.2 Top Cover

Figure 2-7 illustrates the top cover of the Dionex ICS-1600.

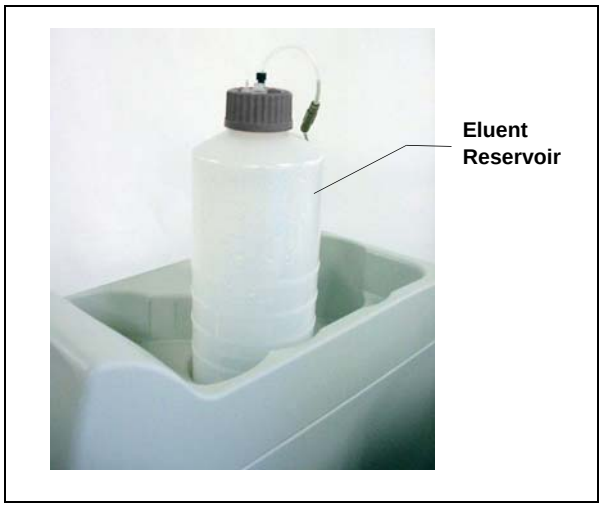


Figure 2-7. Dionex ICS-1600 (Top View)

Reservoir Storage

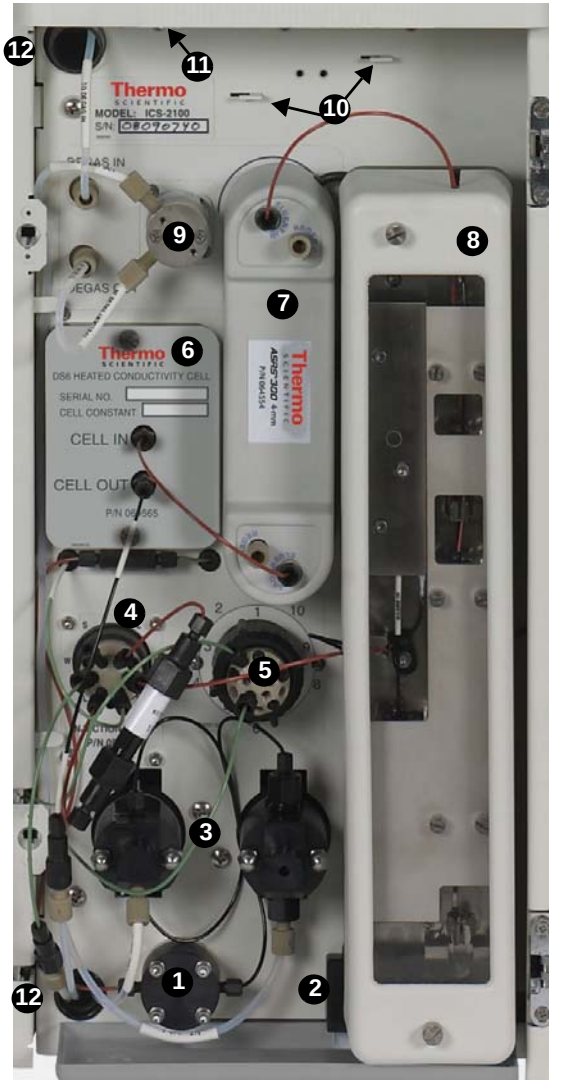
The Dionex ICS-1600 top cover has room for up to three 2-L plastic reservoirs (P/N 044129) *or* one 4-L plastic reservoir (P/N 039164).

Tubing Chase

The tubing chase under the top cover routes tubing to the front of the Dionex ICS-1600.

2.1.3 Component Panel

Figure 2-8 shows the user-accessible components installed on the component panel behind the Dionex ICS-1600 front door.



1. Pressure Transducer
2. Leak Sensor
3. Pump Heads
4. Injection Valve
5. Auxiliary Valve (Optional)
6. DS6 Conductivity Cell
7. Suppressor
8. Column Heater and Columns
9. Eluent Valve
10. Mounting Brackets for Second Suppressor
11. Screen Adjustment Knob (under display)
12. Tubing Chase (2)

Figure 2-8. Dionex ICS-1600 Component Panel

Pressure Transducer

The pressure transducer measures the system backpressure.

Leak Sensor

The leak sensor is installed in the drip tray at the bottom of the component panel. If liquid accumulates in the tray, an error message is logged in the Chromeleon Audit Trail and displayed on the LCD touch screen.

Pump Heads

The Dionex ICS-1600 includes a dual-piston serial pump. The flow rate can be set to 0.00 mL/min or to between 0.05 and 5.00 mL/min. However, for optimum performance, set the flow rate to between 0.40 and 2.00 mL/min. Setting the flow rate to 0.00 mL/min turns off the pump. See Section 2.4.3 for details about the pump.

Injection Valve

The injection valve is a six-port, electrically-activated Rheodyne valve. A 25-µL sample loop (P/N 042857) is installed on the valve at the factory. See Section 2.4.4 for details about valve operation.

Auxiliary Valve (Optional)

The auxiliary valve is a two-position, electrically-activated Rheodyne valve (6-Port Valve Kit, P/N 069472; 10-Port Valve Kit, P/N 069473). See Section 2.4.4 for details about valve operation.

DS6 Heated Conductivity Cell

The flow-through conductivity cell measures the electrical conductance of analyte ions as they pass through the cell. A heat exchanger inside the cell regulates the temperature, which can be set to between 30 and 55 °C. For optimum performance, set the temperature to at least 7 °C above the ambient temperature and 5 °C above the column oven temperature. See Section 2.4.8 for details about the cell.

Suppressor

The suppressor reduces the eluent conductivity and enhances the conductivity of the sample ions, thereby increasing detection sensitivity. Either a Dionex AES™ Atlas Electrolytic Suppressor, Dionex SRS™ Self-Regenerating Suppressor, or Dionex MMS™ MicroMembrane™ Suppressor can be used with the Dionex ICS-1600. See Section 2.4.7 for details about the suppressor.

Separator and Guard Columns

Both the separator and guard columns are packed with resin and perform the separation of the sample ions. The main function of the guard column is to trap contaminants and remove particulates that might damage the separator column.

Column Heater

The column heater controls the temperature of the separator and guard columns. The temperature can be set to between 30 and 60 °C; however, it must be set to at least 5 °C above the ambient temperature. See Section 2.4.6 for details about the column heater.

Eluent Valve

The eluent valve controls the flow from the eluent reservoir. The eluent valve opens automatically when the pump is started and closes when the pump is turned off.

Screen Adjustment Knob

Use this knob to change the LCD touch screen contrast.

Tubing Chases

The upper tubing chase routes tubing from the top cover to the component panel. The lower tubing chase routes tubing from the component panel, through the interior of the Dionex ICS-1600, to the rear panel. It also routes tubing from the RFIC-ER compartment, through the interior of the Dionex ICS-1600, to the component panel.

2.1.4 Right-Side Panel

Figure 2-9 illustrates the RFIC-ER compartment on the right side of the Dionex ICS-1600.

Figure 2-9. RFIC-ER Compartment (Cover Removed)

The compartment houses the ER Controller (ERC 10) and various columns required for operation in the RFIC-ER mode. The ERC 10 electronics monitor the volume of electrolysis gases (such as hydrogen and oxygen) in the eluent stream. If the predefined safety limit is exceeded, the ERC 10 shuts down the pump to prevent the buildup of gases in the eluent bottle.

If you plan to operate in the RFIC-ER mode, you must order one of these kits:

- RFIC-ER Anion Startup Kit, ICS-1100/ICS-1600 (P/N 069570)
- RFIC-ER Cation Startup Kit, ICS-1100/ICS-1600 (P/N 069569)

Each Startup Kit includes one Installation Kit and one Consumables Kit. Together, these kits contain additional items (purification columns, a special eluent bottle, etc.) required for RFIC-ER operation. For more information, refer to the manual shipped with the Installation Kit.

2.1.5 Rear Panel

Figure 2-10 illustrates the Dionex ICS-1600 rear panel.

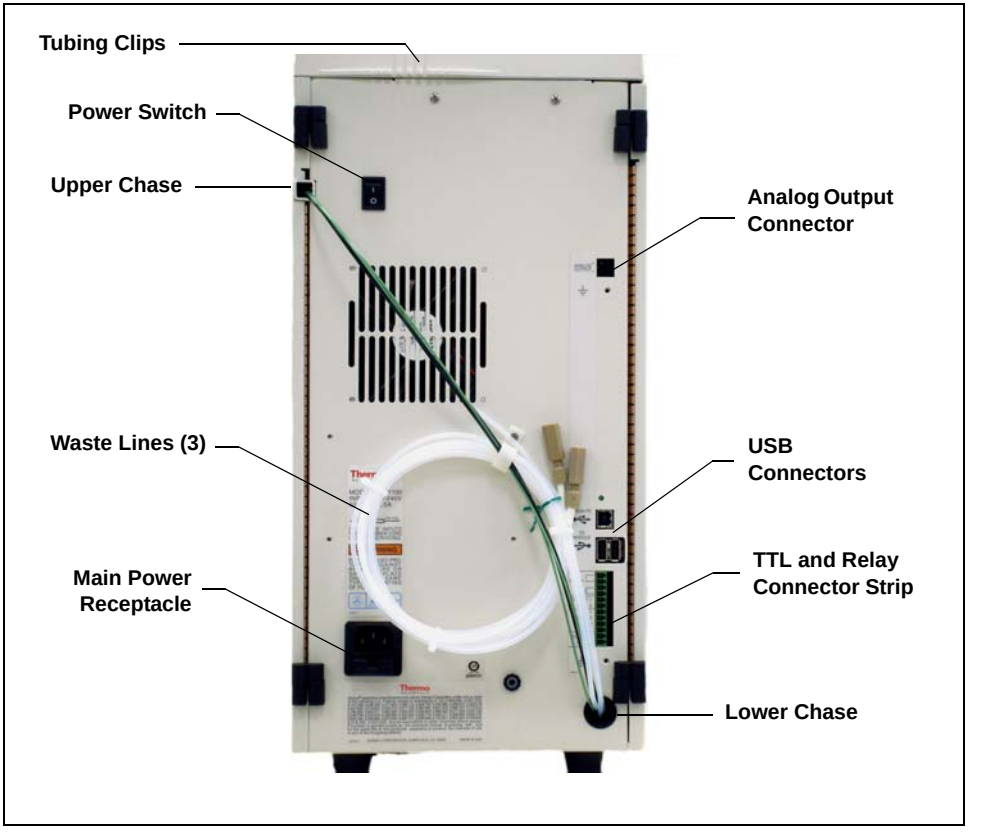


Figure 2-10. Dionex ICS-1600 Rear Panel

Analog Output Connector

The analog output connector outputs conductivity data (as a 0 to 1 V signal) to an integrator or recording device. For connection and setup information, refer to the Dionex ICS-1600 installation instructions.

USB Connectors

A USB receptacle is provided to allow connection to the Chromeleon computer. Two USB ports are provided for connecting to other USB

devices. For connection instructions, refer to the Dionex ICS-1600 installation instructions.

TTL and Relay Connector

The TTL and Relay connector strip provides two TTL outputs, two relay outputs, and four TTL inputs. The outputs can be used to control functions in other TTL- or relay-controllable devices. The inputs can be used to switch the injection valve position, turn on the pump, perform an autozero command, and send an event mark to the analog output. See Section C.1 for connection instructions.

Tubing Chases

The upper tubing chase routes tubing from the RFIC-ER compartment to the Dionex ICS-1600 rear panel. The lower chase routes tubing from the rear panel to the component panel.

Tubing Clips

The tubing clips hold tubing routed from the top cover in place.

Power Switch

The power switch provides on/off control of power to the Dionex ICS-1600.

Main Power Receptacle

The power supply cord plugs into the AC power receptacle.

The power supply cord is used as the main disconnect device. Make sure the socket-outlet is located near the Dionex ICS-1600 and is easily accessible.

Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du module et facilement accessible.

Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.

2.2 Flow Schematics

The following figures illustrate the liquid flow path through a Dionex ICS-1600 when using suppression in autorecycle mode. Two configurations are shown:

- Figure 2-11 illustrates the liquid flow path through components when performing conventional ion chromatography.
- Figure 2-12 illustrates the liquid flow path when operating in the RFIC-ER mode.

Flow Description for Standard Configuration

- Eluent from the eluent reservoir ❶ flows first through the pump degas assembly (if it is installed) and then through the eluent valve❷ to the pump ❸. The eluent is then pushed through the pressure transducer❹, which measures the system pressure.
- From there, the eluent is pushed through a pulse damper❺, which smooths minor pressure variations from the pump to minimize baseline noise. The eluent then flows into the injection valve ❻.
- After sample is loaded into the sample loop ❼ and the injection valve is toggled to the Inject position, eluent passes through the sample loop.
- The eluent/sample mixture is pumped through the heat exchanger ❽, which heats the mixture to the column heater temperature.
- The mixture then goes to the guard ❾ and separator columns and through the suppressor ❿.
- From the suppressor, the mixture flows through the cell⓫, where the analytes are detected. A digital signal is sent to Chromeleon software. Analog output can be collected simultaneously.
- Finally, the mixture flows out of the cell and is recycled back into the suppressor, where it is used as the water source for the regenerant chamber. Flow is then routed to waste ⓬.

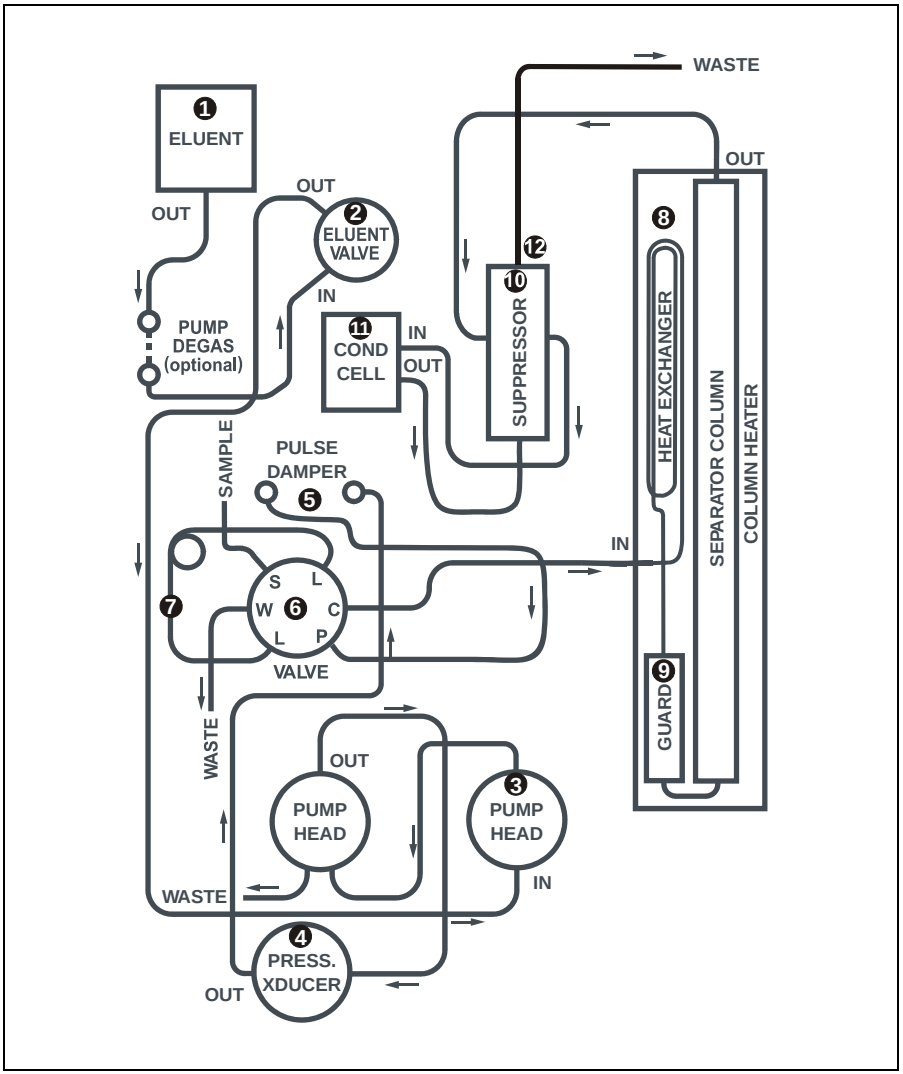


Figure 2-11. Dionex ICS-1600 Flow Schematic: Standard Configuration

Flow Description for RFIC-ER Mode

- Eluent from the eluent reservoir ❶ flows first through the pump degas assembly (if it is installed) and then through the eluent valve ❷ to the pump ❸. The eluent is then pushed through the pressure transducer ❹, which measures the system pressure.
- From there, the eluent is pushed through a pulse damper ❺, which smooths minor pressure variations from the pump to minimize baseline noise. The eluent then flows through the ER1 column ❻ and into the injection valve ❼.
- After sample is loaded into the sample loop ❽ and the injection valve is toggled to the Inject position, eluent passes through the sample loop.
- If the optional column heater is installed, the eluent/sample mixture is pumped through the heat exchanger ❾, which heats the mixture to the column heater temperature.
- The mixture then goes to the guard and separator columns ❿ and through the suppressor ⓫.
- From the suppressor, the mixture flows through the cell ⓬, where the analytes are detected. A digital signal is sent to Chromeleon software. Analog output can be collected simultaneously.
- Finally, the mixture flows out of the cell, through the ER2 column ⓭, and is then recycled back into the suppressor.
- From the suppressor, flow moves to the ER3a and ER3b ⓮ columns, which remove contaminants from the eluent.
- The ERC 10 ⓯ monitors the eluent for gas and shuts down the pump if the gas exceeds a pre-defined limit.
- The output from the ERC 10 is recycled back to the eluent bottle.

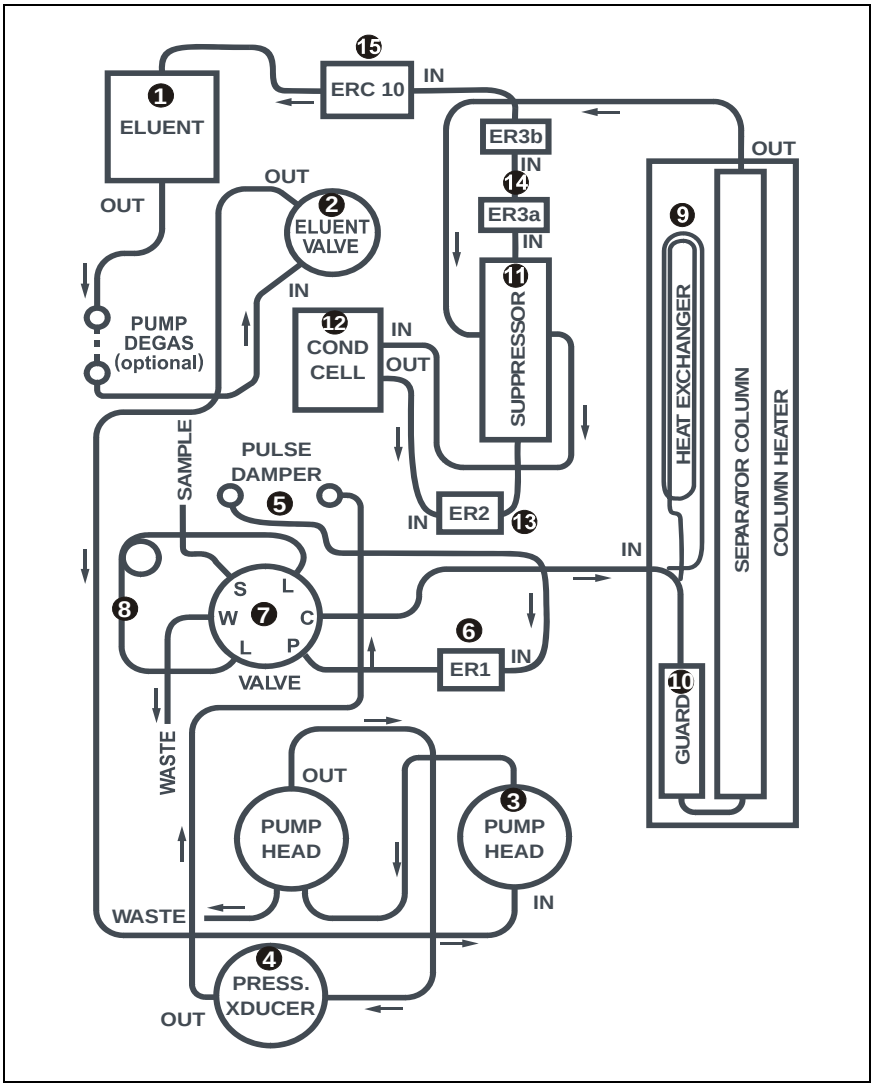


Figure 2-12. Dionex ICS-1600 Flow Schematic: RFIC-ER Mode

2.3 Chromeleon and Chromeleon Xpress

The Dionex ICS-1600 is controlled by a PC configured with Chromeleon Chromatography Management System or Chromeleon Xpress. Chromeleon Chromatography Management System provides complete instrument control, data acquisition, and data management. Chromeleon Xpress provides real-time control and monitoring of instruments, but does not include data management capabilities.

2.3.1 The Panel Tabset

The Chromeleon and Chromeleon Xpress *panel tabset* provides a centralized location for controlling system functions. A panel tabset for a Dionex ICS-1600 system typically includes the following Control panels:

- A Dionex ICS-1600 Control panel (see Figure 2-13) provides access to Dionex ICS-1600 functions. The label on the tab for this panel is the name of the timebase in which the Dionex ICS-1600 is configured.

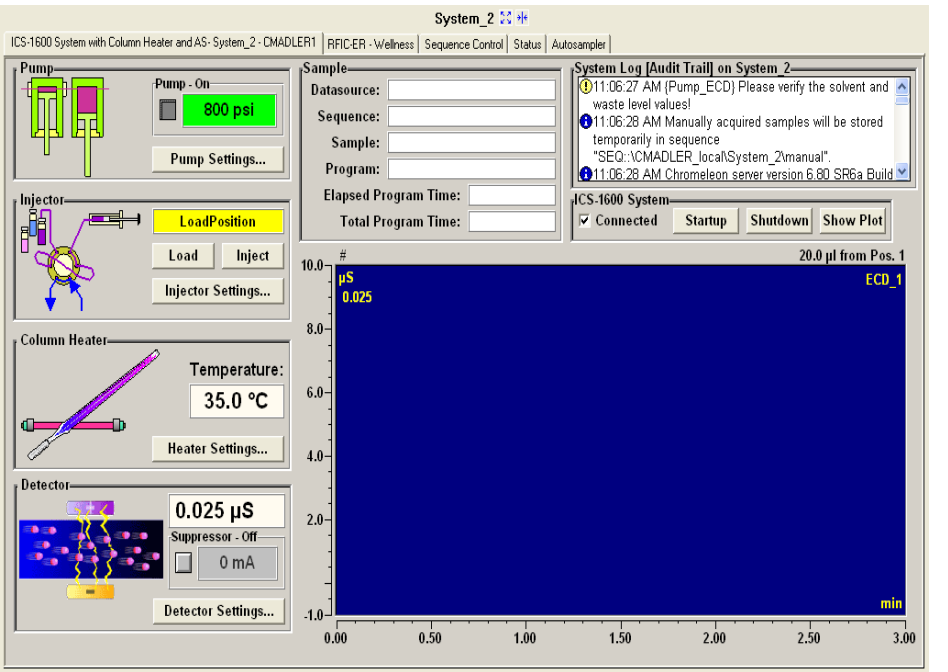
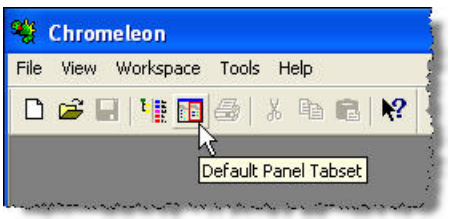


Figure 2-13. Dionex ICS-1600 Control Panel on the Panel Tabset

- A **Sequence Control** panel lets you define and run *sequences* (groups of sample injections to be analyzed in the order in which they are listed).
- A **Status** panel shows the overall system status.
- An **Autosampler** panel (included if the Dionex ICS-1600 is connected to a Dionex AS, Dionex AS-AP, Dionex AS-DV, or Dionex AS-HV Autosampler) provides access to autosampler functions.

To open the panel tabset, use one of the methods below:

- If Chromeleon is installed, start Chromeleon and click the **Default Panel Tabset** toolbar button, or select **View > Default Panel Tabset**.



- If Chromeleon Xpress is installed, start the application; this automatically displays the Dionex ICS-1600 panel tabset.

2.3.2 Software Control Modes

Two modes of software control are available: direct control and programmed control.

- With *direct* control, you select operating parameters and commands from the Control panels. Direct control commands are executed as soon as they are entered.
- With *programmed* control, you create a list of control commands to be executed in chronological order. Programs can be created automatically (with the help of a software wizard).

2.3.3 System Wellness

System Wellness monitors the overall “health” of a chromatographic system. It provides built-in diagnostic and calibration features that help prevent unscheduled system shutdowns and assure reliable operation of system devices. For details about System Wellness, see Section 5.1.

2.4 System Component Details

This section provides details about Dionex ICS-1600 system components, including the vacuum degas assembly (optional), pump, RFIC-ER components, injection valve, column heater, suppressor, and conductivity cell.

2.4.1 Vacuum Degas Assembly (Optional)

The vacuum degas assembly provides online eluent degassing at the time and duration specified by the user. The assembly, which must be installed in the Dionex ICS-1600 at the factory, consists of:

- A single-channel degas chamber (with degas membranes) with internal capacity of 17 mL
- A dual-stage diaphragm vacuum pump
- A solenoid valve
- An on-board vacuum sensor
- The electronics required to operate the vacuum pump
- Tubing, fittings, and other accessories

By default, the Dionex ICS-1600 monitors the degas pressure reading and turns the degas pump on and off as needed. Different degas operating modes can be selected from the touch screen **PUMP** page (see Section B.7) or from Chromeleon.

To select the degas operating options, open the Chromeleon Server Configuration program, right-click the Dionex ICS-1600 device in the timebase, and select **Properties**.

Select the **Options** tab (see Figure 2-14).

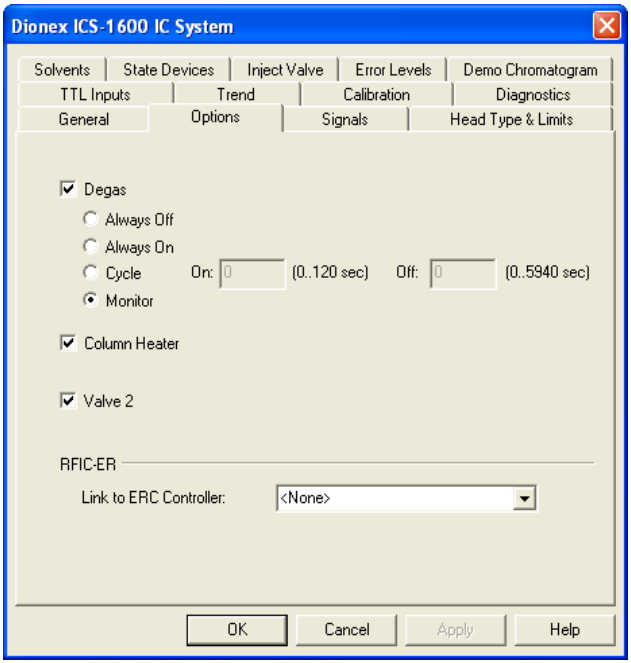


Figure 2-14. Server Configuration Properties: Degas Options

Degas Options

- **Always Off**: The degas pump is always off.
- **Always On**: The degas pump is always on. This setting is for test purposes by a Thermo Fisher Scientific Service Representative. Do not use this setting for routine operation.
- **Cycle**: The degas pump cycles on and off according to the times specified in the **Cycle On** and **Off** fields. **Cycle On** specifies for how long the degas pump runs during a cycle. **Cycle Off** specifies the time between cycles.
- **Monitor**: (default mode) The Dionex ICS-1600 monitors the degas pressure reading and turns the degas pump on and off as required.

2.4.2 Eluent Valve

The eluent valve controls the flow from the eluent reservoir. The valve opens automatically when the pump is started and closes when the pump is turned off. The valve can also be opened and closed manually from the Chromeleon Control panel (see Section 2.3.1) or the touch screen **PUMP** page (see Section B.7). This lets you perform service procedures on pump components without eluent leaks occurring.

Figure 2-15. Eluent Valve

2.4.3 Pump

The Dionex ICS-1600 pump is a microprocessor-based isocratic eluent delivery system. Its variable speed, dual-piston series design ensures pulse-free pumping for the most demanding applications.

Primary Pump Head

The primary pump head pumps eluent into the secondary head (see Figure 2-16). The check valves, which prevent reverse flow through the pump, are located on the bottom (inlet) and top (outlet) of the primary pump head. The priming valve is on the front of the pump head.

To open the priming valve, turn the knob one-quarter to one-half turn counterclockwise. When the priming valve is open, liquid can flow into and out of the primary pump head via the port in the front of the valve.

NOTE The priming valve must be open when the pump is being primed with a syringe or with isopropyl alcohol. For detailed priming instructions, see Section 5.16.

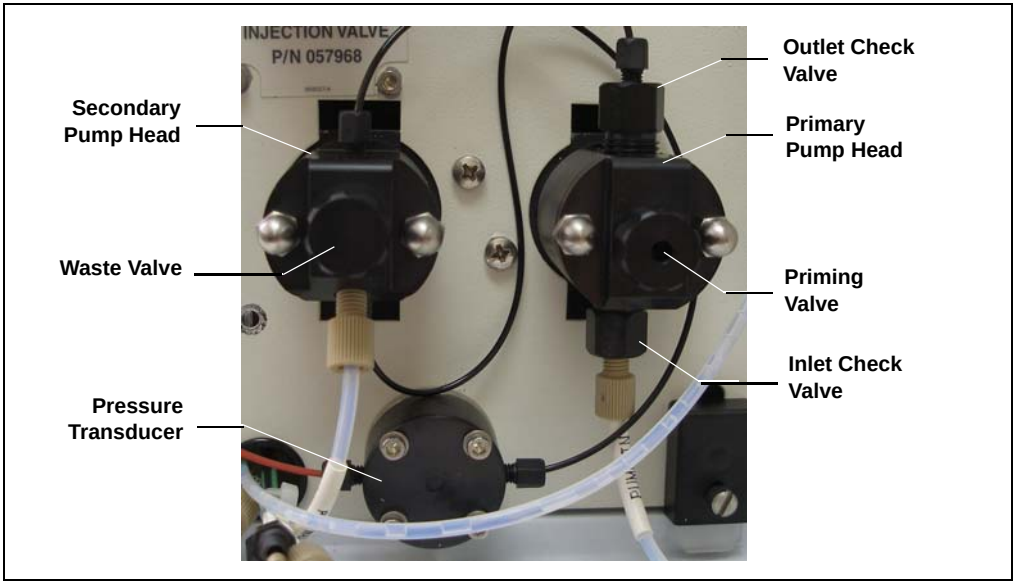


Figure 2-16. Dionex ICS-1600 Pump Components

Secondary Pump Head

The secondary pump head delivers eluent to the remainder of the chromatography system (the injection valve, column, and detector). The waste valve is located on the front of the secondary pump head (see Figure 2-16).

To open the waste valve, turn the knob one-quarter to one-half turn counterclockwise. When the waste valve is in the open position, all pump flow is directed to waste.

NOTE The waste valve must be open when the pump is being primed using the Prime button. For detailed priming instructions, see Section 5.16.

Pressure Transducer

Flow exiting the secondary pump head is directed to the pressure transducer (see Figure 2-16), which measures the system pressure.

Pressure readings indicate that the pumping system is delivering smooth, accurate flow. Pressure readings can be monitored from the Chromeleon Control panel or the touch screen **HOME** page.

The system pressure should remain consistent (no more than a 3% difference from one pressure reading to the next). High and low pressure limits can be used to stop the pump flow if a limit is exceeded. The pressure limits can be set from Chromeleon (in the Server Configuration or in the control program) or from the touch screen **PUMP** page (see Section B.7). See Section 4.2 for troubleshooting information if a pressure limit is exceeded.

Pulse Damper

Flow output from the pressure transducer continues to the pulse damper, which smooths minor pressure variations. From there, flow is directed to the injection valve and then to the remainder of the chromatography system.

Piston Seal Wash

The pump includes a piston seal wash assembly that can be set up to continuously rinse the back of the piston seals to remove salt crystals and prolong the life of the seals. To use this feature, an external water source must be connected. For connection instructions, refer to the Dionex ICS-1600 installation instructions.

For continued protection of the pump, replace the piston rinse seals (see Section 5.7) and O-rings in the seal wash assembly every 6 months, or whenever you replace the main piston seals for the Dionex ICS-1600 pump.

2.4.4 Injection Valve

The injection valve (P/N 057968) is a six-port, electrically-activated valve. A 25-µL sample loop (P/N 042857) is installed on the valve at the factory.

The valve has two operating positions: Load and Inject (see Figure 2-17).

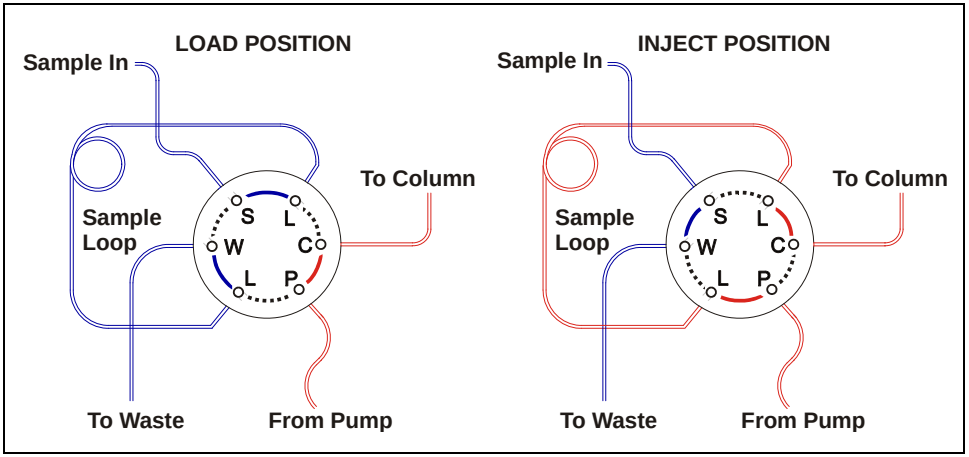


Figure 2-17. Injection Valve Flow Schematics

Eluent flows through either the Load or Inject path, depending on the valve position.

- In the Load position, sample is loaded into the sample loop, where it is held until injection. Eluent flows from the pump, through the valve, and to the column, bypassing the sample loop. Sample flows from the syringe or automated sampler line (if installed), through the valve, and into the sample loop. Excess sample flows out to waste.
- In the Inject position, sample is swept to the column for analysis. Eluent flows from the pump, through the sample loop, and on to the column, carrying the contents of the sample loop with it. Section 3.10 describes how to inject samples.

Figure 2-18 shows the injection valve connections. The injection valve is plumbed at the factory with all tubing and fittings for connection to the pump, injection port, column, and waste. A 25-µL PEEK™ sample loop (P/N 042857) is installed between ports L (1) and L (4). Thermo Fisher Scientific offers sample loops in various sizes. If necessary, the pre-installed 25-µL loop can be replaced with a loop that has a different sample injection volume.

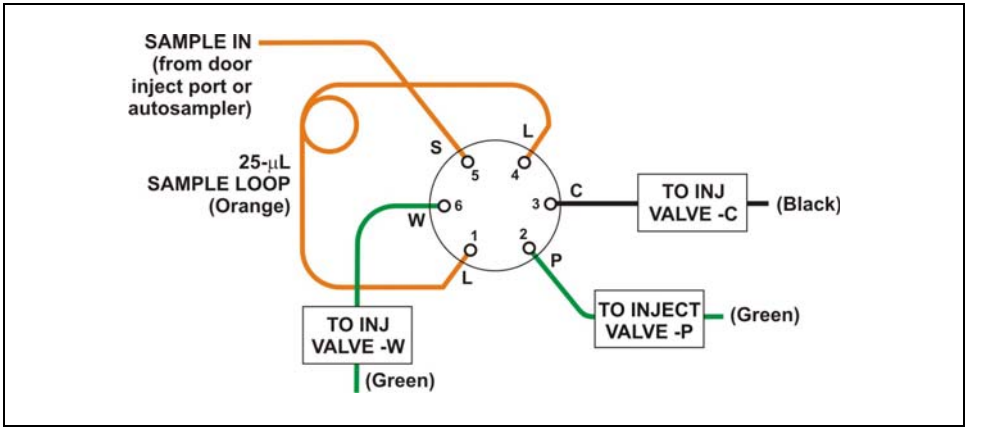


Figure 2-18. Injection Valve Plumbing

2.4.5 Auxiliary Valve (Optional)

The auxiliary valve is a high-pressure Rheodyne valve. The electrically-activated, 2-position PEEK valve is offered in both 6-port and 10-port models (6-Port Valve Kit, P/N 069472; 10-Port Valve Kit, P/N 069473). The auxiliary valve enables a variety of sample preparation activities, including:

- Online filtration
- Matrix elimination (for example, the removal of high backgrounds of chloride or organic material)
- Concentrator-based techniques
- Conditional injections (large loop/small loop applications where the data system monitors sample concentration and reinjects the sample, using the smaller loop, if the concentration is too high)
- AutoNeutralization™
- Matrix diversion prior to MS (mass spectrometry) detection

For more information, refer to *Installing the ICS-1100/ICS-1600/ICS-2100 Auxiliary Valve* (Document No. 065288). The manual is provided in the Auxiliary Valve Kit.

2.4.6 Column Heater

The column heater provides temperature control for the separator and guard column.

The heater temperature can be set to between 30 °C and 60 °C. However, the set temperature must be at least 5 °C above the ambient temperature. A thermistor mounted in the heater block monitors the temperature. Setting the temperature to 0 °C turns off the column heater.

If the temperature exceeds 65 °C, the column heater is shut off and the error message “Column heater exceeds safe temperature.” is displayed on the touch screen and in the Chromeleon Audit Trail. See Section 4.2 for troubleshooting information.

For best results with 2-mm columns, a microbore heat exchanger (P/N 060943) should be installed in the column heater (see Section 5.13). The tubing connections between the injection valve and column heat exchanger, guard column and separator column, and separator column to detector cell should all use red 0.125-mm, 0.005-in ID PEEK tubing (P/N 044221), rather than the standard black tubing.

Figure 2-19. Column Heater

2.4.7 Suppressor

The suppressor reduces the eluent conductivity and enhances the conductivity of the sample ions, thereby increasing detection sensitivity. Either a Dionex Atlas Electrolytic Suppressor, Dionex Self-Regenerating Suppressor, or Dionex MicroMembrane Suppressor can be used with the Dionex ICS-1600.

For details about any of the suppressors or for information about selecting a suppressor for your application, refer to the suppressor manuals. The manuals are on the Thermo Scientific Reference Library DVD (P/N 053891).

2.4.8 DS6 Heated Conductivity Cell

The flow-through conductivity cell measures the electrical conductance of analyte ions as they pass through the cell. Two passivated 316 stainless steel electrodes are permanently sealed into the PEEK cell body. The cell design provides efficient sweep-out, low volume (1 µL), and low dispersion. Temperature control and compensation help ensure good peak reproducibility and baseline stability.

Temperature Control

Temperature directly affects the conductivity of a solution. For example, laboratory heating and air conditioning systems can cause a regular slow cycling in the baseline. This, in turn, can affect the reproducibility of an analysis. The higher the conductivity, the more pronounced the effect.

In ion analysis, the effect of temperature variation is minimized by suppressing eluent conductivity. To further reduce the effect of temperature variation, a heater inside the cell regulates the temperature. The cell heater can be set to between 30 °C and 55 °C. The set temperature must be at least 7 °C above the ambient temperature. Setting the cell temperature to 0 °C turns off the cell heater.

Temperature Compensation

Built-in preset temperature compensation of 1.7% per °C helps minimize changes in the baseline or in peak heights when the operating temperature is different from the temperature at which the cell was calibrated.

DS6 Heated Conductivity Cell Components

The cell front cover provides **CELL IN** and **CELL OUT** fittings for connecting the cell to the suppressor (see Figure 2-8). The remaining cell components are mounted behind the component panel. To replace, the cell remove the screws on the cell front cover and pull the entire cell assembly out through the component panel. See Section 5.10 for cell replacement instructions.

2.4.9 ER Controller

The ER Controller (ERC 10) is installed in the RFIC-ER compartment at the factory. During operation in the RFIC-ER mode, the ERC 10 electronics monitor the volume of electrolysis gases (such as hydrogen and oxygen) in the eluent stream. If the predefined safety limit is exceeded, the ERC 10 shuts down the Dionex ICS-1600 pump to prevent the buildup of gases in the eluent bottle.

3 • Operation and Maintenance

This chapter describes routine operating and maintenance procedures for the Dionex ICS-1600.

The Dionex ICS-1600 is designed for IC (ion chromatography) applications and should not be used for any other purpose. Operation of the Dionex ICS-1600 in a manner not specified by Thermo Fisher Scientific may result in personal injury.

3.1 Operation Overview

Figure 3-1 illustrates the basic steps for routine operation of the Dionex ICS-1600.

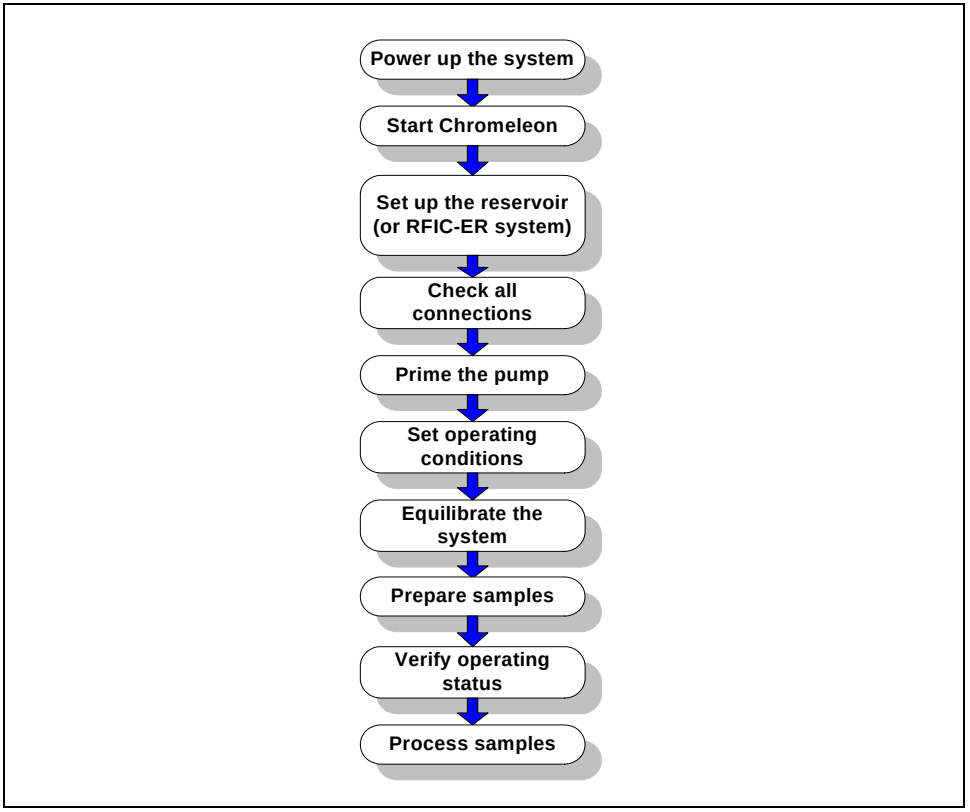


Figure 3-1. Operation Flow Chart

Sample Processing Overview

Samples can be run manually (one at a time), or they can be grouped and run automatically in batches. Figure 3-2 shows the typical steps for manual and batch sample processing.

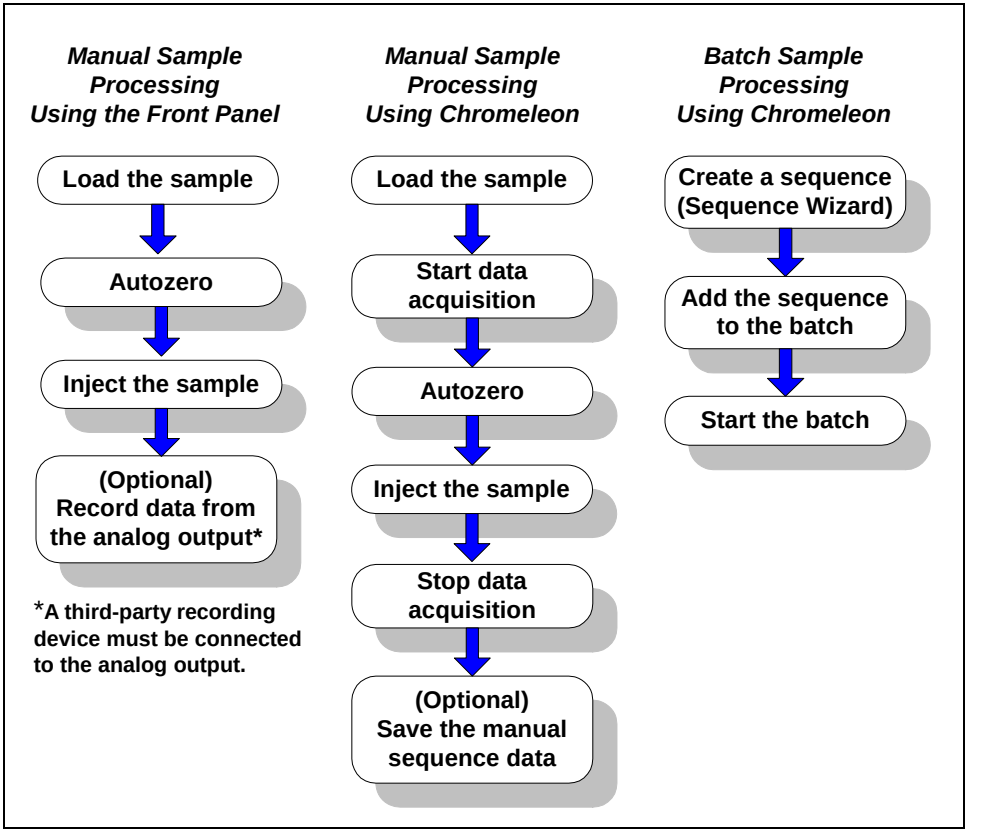

Manual Sample Processing Using the Front Panel
Load the sample
Autozero
Inject the sample
(Optional) Record data from the analog output*
*A third-party recording device must be connected to the analog output.
Manual Sample Processing Using Chromeleon
Load the sample
Start data acquisition
Autozero
Inject the sample
Stop data acquisition
(Optional) Save the manual sequence data
Batch Sample Processing Using Chromeleon
Create a sequence (Sequence Wizard)
Add the sequence to the batch
Start the batch

Figure 3-2. Sample Processing Overview

3.2 Turning On the System Power

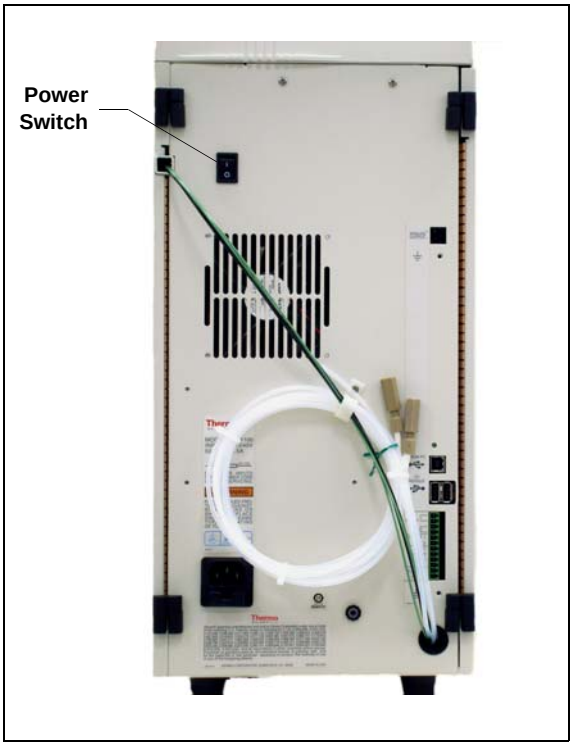


Figure 3-3. Dionex ICS-1600 Rear Panel

Press the power switch on the Dionex ICS-1600 rear panel (see Figure 3-3) to turn on the system power. Table 3-1 shows the Dionex ICS-1600 conditions at power-up.

Also turn on the power to the computer and the autosampler (if used).

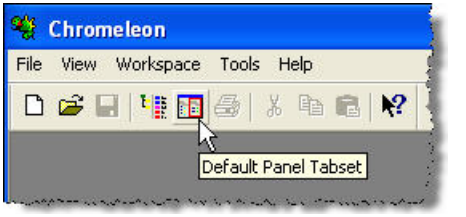
Feature	Power-Up Condition
Pump	Off
Injection valve	Load position
Cell	Reading current value
Suppressor	Off*
Cell heater	Set to the last value used. The default when the Dionex ICS-1600 is turned on for the first time is 35 °C.
Column oven temperature	Set to the last value used. The default when the Dionex ICS-1600 is turned on for the first time is 30 °C.
* When you start the suppressor, the value used last is restored.	

Table 3-1. Dionex ICS-1600 Power-Up Conditions

3.3 Connecting to Chromeleon

NOTE **If you are beginning operation of a Dionex ICS-1600 that has not been configured in a timebase, refer to the Dionex ICS-1600 installation instructions for Chromeleon setup instructions.**

1. Turn on the PC.
2. Start the Chromeleon Server, if it is not already running.
   a. Check the Chromeleon Server Monitor icon on the Windows taskbar.
      - When the server is running, the icon is gray .
      - When the Server is not running, the icon is crossed out in red). To start the server, right-click the icon and select **Start Server**.
   b. If the Server Monitor icon is not on the Windows taskbar, click **Start** > **All Programs** > **Chromeleon** > **Server Monitor**. The Server Monitor opens. Click **Start** to start the server.
3. To start the Chromeleon client, click **Start** and select **All Programs** > **Chromeleon** > **Chromeleon**.
4. If Chromeleon is installed, the main window and Browser appear. Display the panel tabset by selecting **View** > **Default Panel Tabset** or by clicking the **Default Panel Tabset** toolbar button.



   If Chromeleon Xpress is installed, starting the application automatically displays the panel tabset.
5. To display the Dionex ICS-1600 Control panel, click the tab labeled with the Dionex ICS-1600 timebase name (see Figure 3-4).

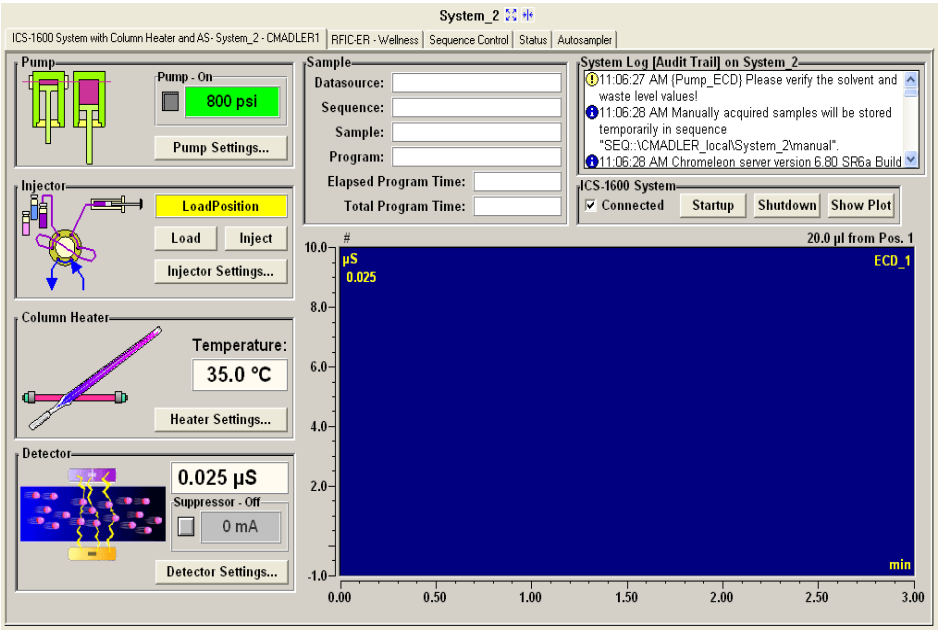


Figure 3-4. Dionex ICS-1600 Control Panel on the Chromeleon Panel Tabset

3.4 Set Up the Eluent Reservoir

NOTE If you plan to operate the system in the RFIC-ER mode, disregard the instructions here. Follow the instructions provided with your RFIC-ER Installation Kit to set up the RFIC-ER eluent reservoir.

3.4.1 Prepare the Eluent

Prepare the eluent according to the instructions in the column manual. Column manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).

3.4.2 Degas the Eluent

Eluent quality significantly affects the performance of the Dionex ICS-1600. To ensure optimal pump performance, observe the following precautions:

- Dionex strongly recommends vacuum degassing all eluents. This helps prevent bubbles, caused by outgassing, from forming in the pump heads and the detector flow cell.
- The optional vacuum degas assembly provides programmable, online degassing. The degas assembly must be installed in the Dionex ICS-1600 at the factory. If the Dionex ICS-1600 does not contain a degas assembly, manually degas eluent daily (following the instructions below) and store it in pressurized reservoirs.

Manual Degassing of Eluent

1. Prepare the eluent required for the application and pour it into a vacuum flask.
2. Attach the flask to a vacuum pump or water aspirator.
3. Vacuum degas the eluent for 5 to 10 minutes by shaking or sonication.
4. Remove the flask from the vacuum. **Do not allow eluent to flow from the aspirator back into the flask.**
5. Pour the degassed eluent into a pressurizable reservoir. **Do not shake the eluent.**

6. Install an end-line filter on the eluent line (see Section 3.4.3).
7. (Optional) Pressurize the reservoir.

   The Dionex ICS-1600 does not require pressurized reservoirs. However, if eluent is manually degassed or is sensitive to contamination, Dionex recommends pressurizing the reservoir with helium or nitrogen.

   The air regulator accessory bracket and other items needed for pressurizing the eluent reservoir must be ordered separately (P/N 060054). For more information, refer to the Dionex ICS-1600 installation instructions.

3.4.3 Filter the Eluent

Filtering removes small particulates in the eluent that may contaminate the pump check valves and cause erratic flow rates or loss of prime. An end-line filter (P/N 045987) is provided in the Dionex ICS-1600 Ship Kit (P/N 067110) for this purpose.

Install the end-line filter on the end of the eluent line, inside the reservoir. Verify that the end of the filter extends to the bottom of the reservoir and that the filter is submerged in eluent. This prevents air from being drawn through the lines.

3.4.4 Fill the Reservoir

Fill the reservoir with the prepared eluent.

3.4.5 Set the Eluent Level

After filling the reservoir, enter the volume of liquid in the reservoir in one of the following locations:

- On the **HOME** page in the **Eluent Level** field (see Figure 3-5)
- In the **Eluent Bottle** field in the **Pump Settings** window (accessed from the Dionex ICS-1600 Control panel on the Chromeleon panel tabset (see Figure 3-4)

The Dionex ICS-1600 determines the eluent usage by monitoring the flow rate and the length of time the pump is on, and updates the **Eluent Bottle**

volume as the eluent is depleted. A warning appears if the level falls below 200 mL. Warnings are repeated at 100 mL and 0 mL.

IMPORTANT **In order for the level displayed in the Eluent Bottle box and gauge to be accurate, you must enter the level when the reservoir is filled. The Dionex ICS-1600 does not automatically detect when the reservoir is filled, nor when it is empty.**

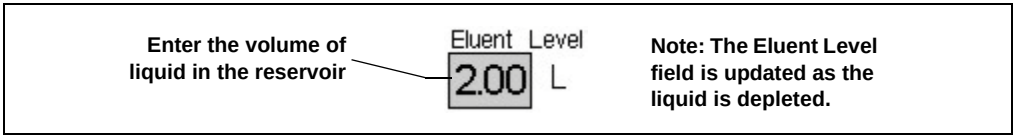

Enter the volume of liquid in the reservoir
Eluent Level
2.00
L
Note: The Eluent Level field is updated as the liquid is depleted.

Figure 3-5. Home Page: Setting the Eluent Level

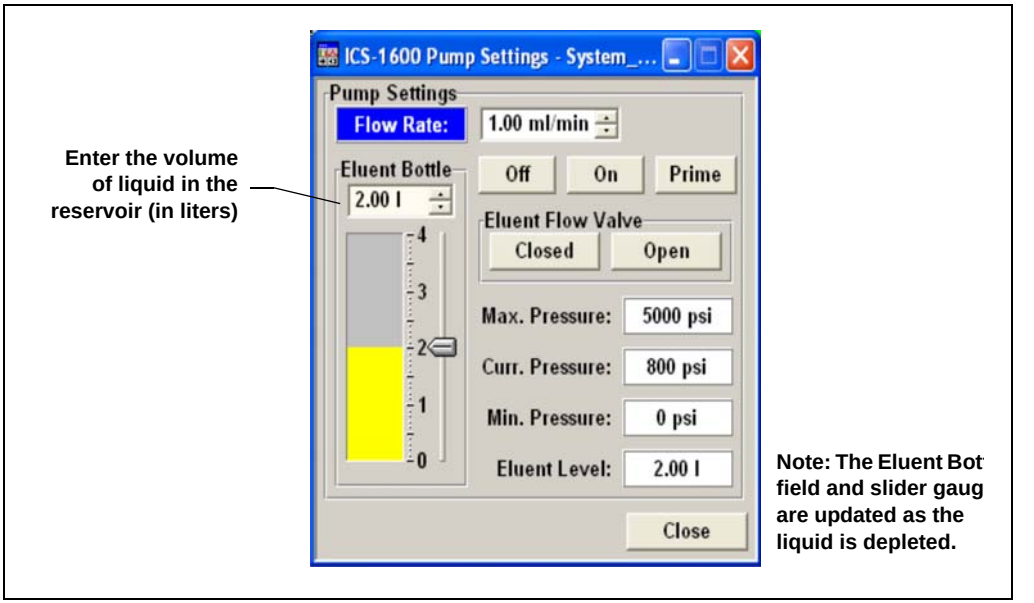


Figure 3-6. Pump Settings Windows: Setting the Eluent Level

The **STATUS** page (see Figure 3-7) also displays the amount of liquid remaining in the reservoir and an estimate of how many hours remain before the eluent reservoir is empty.

See Section B.6 for details about the **STATUS PAGE**.

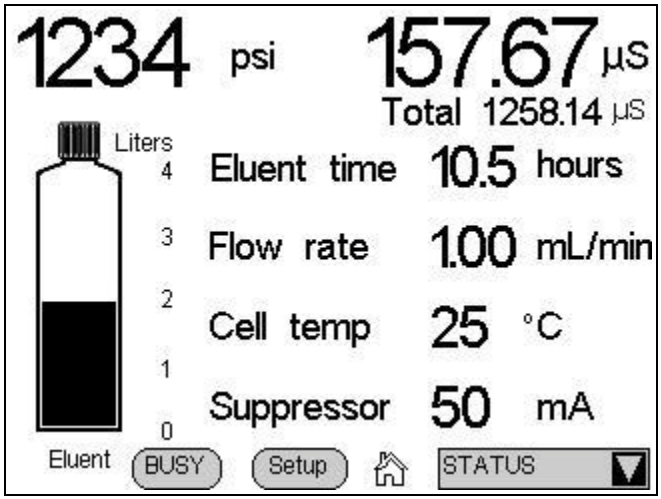


Figure 3-7. Status Page

3.4.6 Connect the Reservoir

If it is not already connected, connect the **ELUENT BOTTLE OUT** line from the reservoir cap to the **ELUENT IN** line, which extends from the plumbing and cable chase on the top of the Dionex ICS-1600.

3.5 Check All Connections

Make sure the eluent reservoir is filled and the tubing connecting the reservoir to the Dionex ICS-1600 tubing is securely connected.

3.6 Prime the Pump

IMPORTANT **If you changed eluent or if the eluent lines are dry, prime the lines first with a syringe before following the procedure below to prime the pump. See Section 5.16.1 for instructions on priming the lines with a syringe.**

1. Verify that the priming valve on the primary pump head (see Figure 3-8) is closed (turned all the way clockwise).

2. Open the waste valve on the secondary pump head by turning the knob one-quarter to one-half turn counterclockwise. Opening the valve directs the eluent flow path to waste and eliminates backpressure.

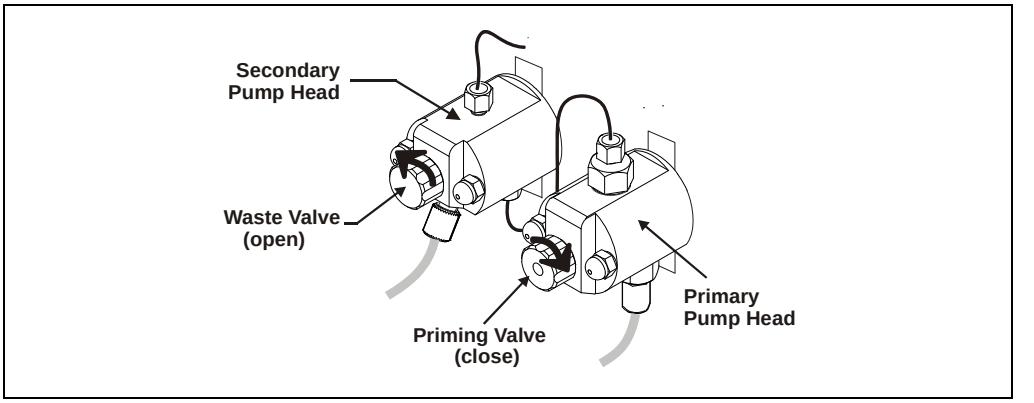


Figure 3-8. Priming the Pump

3. Press **Prime** on the Chromeleon Control panel or the Dionex ICS-1600 touch screen **HOME** page. Confirm that the waste valve is open by pressing **OK** when the reminder message appears. The pump will begin pumping at approximately 3 mL/min.
4. Continue priming the Dionex ICS-1600 until all air and previous eluent are purged and no air bubbles are exiting the waste line.
5. Press **Pump Off**.
6. Close the waste valve. **Do not overtighten.** The pump is now ready for operation.

3.7 Set System Operating Conditions

NOTE **This section is an overview of the steps needed to start up the system and begin running samples. Actual operating parameters (flow rate, cell heater temperature, suppressor current, etc.) depend on the application to be run. Refer to the column manual for the required parameters for your application.**

Set or verify system operating parameters from either the Chromeleon Control panel or from the touch screen **HOME** page. Operating parameters can also be set automatically by loading a Chromeleon sequence.

NOTE Clicking the System Startup button on the Chromeleon Control panel starts the pump and suppressor. The flow rate and suppressor current settings that were in effect when the system was shut down are restored.

1. Verify that the pump is on and set to the correct flow rate.
2. Verify that the suppressor current is on and that the setting is correct.
3. Verify that the cell heater is set to the correct value.
4. Verify that the column heater is set to the correct value.

Automatically Turning on the Suppressor

You can set up the Dionex ICS-1600 to turn on the suppressor automatically when the pump is turned on. To do this, select the **Automatically turn on with pump** option from the **SUPPRESSOR** page.

The suppressor is always turned off automatically when the pump is turned off.

3.8 Equilibrate the System and Verify Operational Status

NOTE You can monitor system functions (conductivity, pressure, cell temperature, etc.) from the Chromeleon Control panel or from the touch screen HOME page.

1. Allow the system to equilibrate. During equilibration, the Chromeleon Control panel displays the background conductivity (the conductivity of the eluent before sample injection) and the system backpressure.
2. Monitor the background conductivity. Refer to the column manual for the appropriate background conductivity for your application.
3. Offset the background and zero the reading by clicking the **Autozero** button on the Chromeleon Control panel (see Figure 3-4).
4. Monitor the system pressure from the Control panel to make sure it is at the expected pressure for the installed column (refer to the column manual for details) and is stable.

- If the pressure is less than the expected amount, gas may be trapped in the system. To release the gas, remove the pump fitting on the injection valve port, labeled **P** (**2**). Allow the air to escape and then reconnect the fitting.
- If the pressure fluctuates by more than about 0.13 MPa (20 psi), prime the pump. See Section 4.4 for additional troubleshooting information.
- If the pressure is too high, there may be a restriction in the system plumbing. See Section 4.8 for troubleshooting information.

5. Verify that the baseline conductivity is at the expected reading for your application and is stable. In general, it should be <30 µS for a system set up for anion analyses and <2 µS for a system set up for cation analyses. See Section 4.13 for troubleshooting information if the conductivity is too high. See Section 4.14 if the baseline is drifting or has excessive "noise" (large fluctuations in readings).
6. Verify that the cell heater is at the set point and is stable. The temperature is at equilibrium when the **Set Temperature** and the **Current Temperature** readings on the Control panel are the same, or when the "**=**" symbol is displayed next to the **Column Heater** temperature on the **HOME** page.
7. Verify that the column heater temperature is at the set point and stable. The temperature is at equilibrium when the **Set Temperature** and the **Current Temperature** readings on the Control panel are the same, or when the "**=**" symbol is displayed next to the **Column Heater** temperature on the **HOME** page.

The system is now ready for sample processing.

3.9 Prepare Samples

NOTE Sample preparation can be performed while the system is equilibrating.

3.9.1 Collecting and Storing Samples

Collect samples in high density polyethylene containers that have been thoroughly cleaned with deionized (DI) water. Do not clean containers with strong acids or detergents because these can leave traces of ions on the container walls. The ions may interfere with the analysis.

If samples will not be analyzed on the day they are collected, filter them through clean 0.45 µm filters immediately after collection; otherwise, bacteria in the samples may cause the ionic concentrations to change over time. Refrigerating the samples at 4° C (39° F) will reduce, but not eliminate, bacterial growth.

Analyze samples containing nitrite or sulfite as soon as possible. Nitrite oxidizes to nitrate, and sulfite to sulfate, thus increasing the measured concentrations of these ions in the sample. In general, samples that do not contain nitrite or sulfite can be refrigerated for at least one week with no significant changes in anion concentrations.

3.9.2 Pretreating Samples

Analyze rainwater, drinking water, and air particulate leach solutions directly with no sample preparation (other than filtering and possibly diluting).

Filter groundwater and wastewater samples through 0.45 µm filters before injection, unless samples were filtered after collection.

Before injection, pretreat samples that may contain high concentrations of interfering substances by putting them through Dionex OnGuard™ cartridges. Refer to *Installation and Troubleshooting Guide for OnGuard Cartridges* (Document No. 032943) for instructions.

3.9.3 Diluting Samples

Because the concentrations of ionic species in different samples can vary widely from sample to sample, no single dilution factor can be recommended for all samples of one type. In some cases (for example, many water samples), concentrations are so low that dilution is not necessary.

Use eluent or ASTM filtered, Type I (18-megohm) deionized water to dilute the sample. When using carbonate eluents, diluting with eluent minimizes the effect of the water dip at the beginning of the chromatogram. If you dilute the sample with eluent, also use eluent from the same lot to prepare the calibration standards. This is most important for fluoride and chloride, which elute near the water dip.

To improve the accuracy of early eluting peak determinations, such as fluoride, at concentrations below 50 ppb, dilute standards in eluent or

spike the samples with concentrated eluent to minimize the water dip. For example, spike a 100 mL sample with 1.0 mL of a 100 X eluent concentrate.

3.10 Loading and Injecting Samples

NOTE Samples can be injected using either the standard injection valve or the optional auxiliary valve, if installed. For more information, see the Chromeleon Help or user's manual.

The two techniques for loading samples into the sample loop are: (1) with an autosampler or (2) with a syringe or vacuum syringe through the injection port on the Dionex ICS-1600 front door.

For autosampler injections, the injection port tubing is disconnected from the Dionex ICS-1600 injection valve and replaced by the autosampler outlet tubing. Other setup requirements depend upon the model of autosampler.

Setup for a Dionex AS Autosampler

To use a Dionex AS Autosampler with the Dionex ICS-1600, the following requirements must be met:

- The Dionex ICS-1600 injection valve (or the auxiliary valve, if installed) must be specified as the injection valve and must be linked to the Dionex AS in the Chromeleon timebase.
- An injection valve should not be installed in the Dionex AS.

See the Dionex ICS-1600 installation instructions for Dionex AS connection instructions.

NOTE The Dionex ICS-1600 and the Dionex AS can be set up for stand-alone (front panel) operation. This requires a TTL cable connection between the Dionex ICS-1600 and the Dionex AS. See Section C.3 for stand-alone setup instructions.

Setup for a Dionex AS-DV Autosampler

To use a Dionex AS-DV Autosampler with the Dionex ICS-1600, the following requirements must be met:

- The Dionex ICS-1600 injection valve must be linked to the Dionex AS-DV in the Chromeleon timebase.

Setup for a Dionex AS-HV Autosampler

For setup information for the Dionex AS-HV Autosampler, see the *Dionex AS-HV Autosampler Operator's Manual* (Document No. 065125). The manual is provided on the Thermo Scientific Reference Library DVD (P/N 053891).

3.10.1 Loading Samples with a Syringe

1. Make sure the injection port on the Dionex ICS-1600 front door (see Figure 2-1) is connected to sample port **S (5)** on the injection valve (see Figure 3-9).

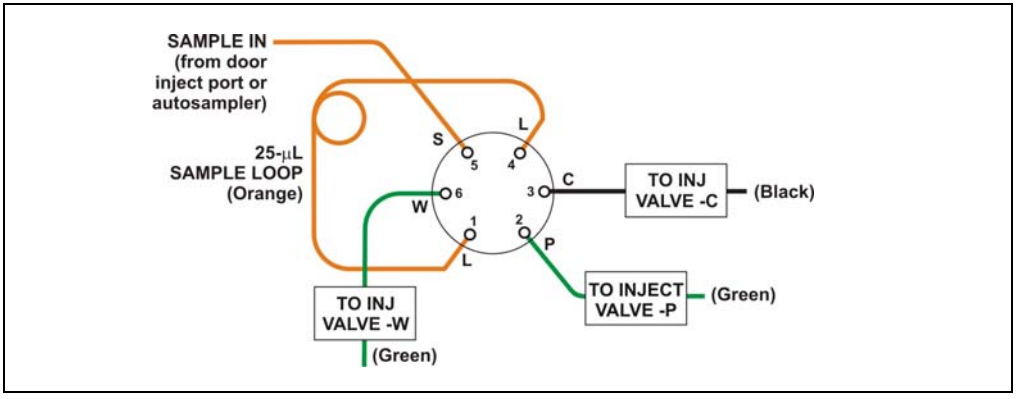


Figure 3-9. Injection Valve Connections

2. Fill the 1 cc syringe (P/N 016388) provided in the Dionex ICS-1600 Ship Kit (P/N 067110) with a calibration standard or sample.
3. Insert the syringe into the injection port on the Dionex ICS-1600 front door (see Figure 2-1).
4. Verify that the injection valve is in the Load position.
5. Overfill the sample loop with several sample loop volumes. Excess sample will exit through the injection valve waste line.

6. Leave the syringe in the port.
7. Switch the injection valve to the Inject position (see Section 3.10.4).

3.10.2 Loading Samples with a Vacuum Syringe

1. Disconnect the waste line from port **W (6)** of the injection valve (see Figure 3-9) and attach a shorter line: 25 to 30 cm (10 to 12 inches) of PEEK or PTFE (polytetrafluoroethylene) tubing.
2. Place the free end of the line into the sample.
3. Verify that the injection valve is in the Load position.
4. Insert the 1 cc syringe (P/N 016388) provided in the Dionex ICS-1600 Ship Kit (P/N 067110) into the injection port on the Dionex ICS-1600 front door (see Figure 2-1) and pull out the plunger to draw the sample into the injection valve.
5. Switch the injection valve to the Inject position (see Section 3.10.4).

3.10.3 Loading Samples with an Autosampler

1. Verify that the autosampler output line is connected to port **S (5)** of the Dionex ICS-1600 injection valve.
2. Prepare and fill the sample vials and place them in the autosampler tray or cassette. Refer to the autosampler manual for detailed instructions.
3. The sample loading process depends on the autosampler. Refer to the autosampler manual for detailed instructions. In general, use one of the following methods:
   - Include the commands for controlling sample loading in a Chromeleon program. (If necessary, refer to the Chromeleon Help or user manual for assistance.)
   - Enter the commands for loading the sample on the autosampler front panel.
4. Switch the injection valve to the Inject position (see Section 3.10.4).

3.10.4 Injecting Samples

After loading the sample in the sample loop, use one of the following methods to switch the injection valve to the Inject position:

- Manually: Click the **Inject** button on the Chromeleon Control panel (see Figure 3-4) or touch the **Inject** button on the **HOME** page.
- Automatically: Include the Inject command in a Chromeleon program. (If necessary, refer to the Chromeleon Help or user manual for assistance.)

3.11 Processing Samples

Samples can be run manually (one at a time) or else they can be grouped and run automatically in batches.

3.11.1 Manual Sample Processing

To process samples manually, select operating parameters and commands from the touch screen pages, or from the Chromeleon menu bar, toolbars, and Control panel. Commands are executed as soon as they are entered.

NOTE When you run samples manually from the front panel (without using Chromeleon), the data is saved only temporarily in the Dionex ICS-1600 memory. For a permanent record of the data, connect a recording device (chart recorder, integrator, etc.) to the analog output. For output connection instructions, refer to.

1. Complete the instructions in Section 3.2 through Section 3.8 to prepare the Dionex ICS-1600 for operation and to prepare the sample for processing.
2. Load the sample, using a syringe, vacuum syringe, or autosampler (see Section 3.10).
3. In Chromeleon, select **Control > Acquisition On**. Chromeleon records the signal supplied by the detector and displays the signal plot on the Control panel.

4. Click the **Autozero** button on the Control panel or the touch screen **HOME** page.
5. Inject the sample (see Section 3.10.4).
6. In Chromeleon, monitor the chromatogram on the Control panel and select **Control > Acquisition Off** when sample data is collected.

   NOTE Data from Chromeleon manual processing is saved in the MANUAL sequence folder under the local datasource. This data is overwritten each time a new manual sample is processed. To save the data from a manual run, select the MANUAL folder, select File > Save As, and enter a new name for the sequence.

7. If you are controlling the Dionex ICS-1600 from the touch screens, select the **PLOT** button on the **HOME** page to view a plot of the conductivity data.

3.11.2 Automatic (Batch) Sample Processing

You can use Chromeleon or Chromeleon Xpress to create a list of samples (a sequence) to be processed automatically. For each sample, the sequence includes the following:

- A program with commands and parameters for controlling the Dionex ICS-1600 and autosampler (if used), and for acquiring sample data.
- A quantification method for peak identification and area determination.
- Additional sample processing parameters (sample name, sample type, injection volume, etc.).

After creating the sequence, you can start batch processing.

Summary of Automatic Sample Processing

1. Complete the instructions in Section 3.2 through Section 3.8 to prepare the Dionex ICS-1600 for operation and to prepare the sample for processing.
2. If an autosampler is installed, prepare and fill the sample vials and place them in the autosampler tray or cassette. Refer to the autosampler manual for detailed instructions. Autosampler manuals are provided on the Thermo Scientific Reference Library DVD (P/N 053891).
3. If an autosampler is not installed, load the sample into the injection valve sample loop through the sample port on the Dionex ICS-1600 front door (see Section 3.10.1).
4. Use the Application Wizard to specify a program and quantitation method, and create a sequence:
   a. On the **Sequence Control** panel, click **Application Wizard**.
   b. Select an application template from the list (see Figure 3-10).

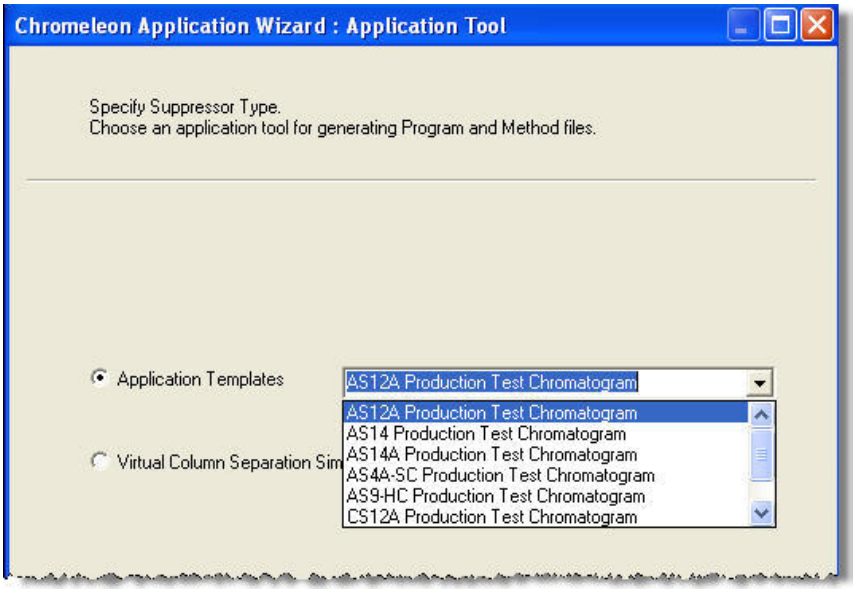

Chromeleon Application Wizard : Application Tool
Specify Suppressor Type.
Choose an application tool for generating Program and Method files.
Application Templates
AS12A Production Test Chromatogram
Virtual Column Separation Sim
AS12A Production Test Chromatogram
AS14 Production Test Chromatogram
AS14A Production Test Chromatogram
AS4A-SC Production Test Chromatogram
AS9-HC Production Test Chromatogram
CS12A Production Test Chromatogram

Figure 3-10. Application Wizard

c. Click **Next >** and select the **in a new sequence via Sequence Wizard** option.

d. Click **Next >** to go to the Sequence Wizard.

e. Complete the steps in the Sequence Wizard, adding the desired number of samples and standards to the list. For help, click the **Help** button on the Sequence Wizard page.

After you click **Finish**, a sequence is created and a program appropriate for the selected application is copied to the sequence. If you are using Chromeleon, a quantification method is also copied to the sequence.

5. Load the sequence and start batch processing:

a. On the **Sequence Control** panel, click **Load Sequence**.

b. Select the sequence created in Step 4 and click **Open**.

c. Click **Start Batch**.

3.12 Maintenance

This section describes routine maintenance procedures that users may perform. All other maintenance procedures must be performed by Thermo Fisher Scientific personnel.

As Needed

- Regularly check the eluent reservoir and refill when needed.
- Make fresh eluent as needed.
- RFIC-ER systems only: The Chromeleon RFIC-ER Wellness feature tracks the usage of the RFIC-ER eluent and columns. An Audit Trail message will inform you when an item is approaching the end of its useful life span. You can also check the life expectancy of these components on the RFIC-ER Wellness panel.

Daily

- Check the Dionex ICS-1600 component panel (see Figure 2-8) for leaks or spills. Wipe up spills. Isolate and repair leaks (see Section 4.3). Rinse off any dried eluent with deionized water.

- Check the waste container daily and empty when needed.

Weekly

- Once a week, check fluid lines for crimping or discoloration. Replace any pinched lines. Replace damaged lines.
- Check the junctions between the pump heads and the pump casting for evidence of liquid leaks. If the piston seal wash tubing is not connected, check the drain tubes at the rear of the pump heads for evidence of moisture. Normal friction and wear may gradually result in small liquid leaks around the piston seal. If unchecked, these leaks can gradually contaminate the piston housing, causing the pump to operate poorly. If leaks occur, replace the piston seals (see Section 5.7).
- Check the end-line filter (P/N 045987) and change if needed. When new, end-line filters are pure white. If the system is in continuous operation, change the end-line filter weekly, or whenever it becomes discolored. Replace the filter more often if bacterial buildup is visible or if the eluent does not contain solvent.

NOTE **It is especially important to regularly replace end-line filters when using aqueous eluents, which may contaminate the filter with bacteria or algae. The bacterial buildup may not be visible.**

Every Six Months

- Calibrate the cell (see Section 5.1.3).
- Calibrate the vacuum degas assembly (see Section 5.1.5).
- Replace the pump piston rinse seals and piston seals (see Section 5.7).

Yearly

- Thermo Fisher Scientific recommends performing preventive maintenance annually, as well as before scheduled Performance Qualification tests. A Dionex ICS-1600 Preventive Maintenance Kit (P/N 057954) is available for this purpose.
- Rebuild the auxiliary valve, if installed (see Section 5.4).
- If a Dionex AS Autosampler is installed, perform the preventive maintenance procedure. The Dionex AS Preventive Maintenance Kit (P/N 060581) is available for this purpose.

- If a Dionex AS-DV Autosampler is installed, replace the tip and tubing. The Dionex AS-DV Preventive Maintenance Kit (P/N 055647) contains all of the components required to replace the sampling tip and the tubing between the tip and the injection valve. Instructions are included with the kit.

4 • Troubleshooting

This chapter is a guide to troubleshooting minor issues that may arise during operation of the Dionex ICS-1600. Turn to the section of this chapter that best describes the operating problem or symptom that has been observed. Each section lists possible causes of the problem or symptom in order of probability. A systematic troubleshooting approach is the most effective way to determine the root cause.

If you are unable to resolve a problem by following the instructions here, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office. Please have this chapter at hand when talking with Technical Support personnel.

4.1 Error Messages

The Moduleware (the instrument control firmware installed in each Dionex ICS-1600 module) periodically checks the status of certain parameters. If a problem is detected, it is displayed on the touch screen.

Error messages are also reported to Chromeleon and logged in the Audit Trail. Each error message is preceded by an icon that identifies the seriousness of the underlying problem (see the table below). You can change the severity level assigned to a problem whenever appropriate.

Icon	Severity Level	Description
	Warning	A message is displayed in the Audit Trail, but the current run is not interrupted.
	Error	A message is displayed in the Audit Trail, and the system attempts to correct the problem (sometimes by using an alternative parameter). An Error never interrupts the current analysis; however, if it occurs during the Ready Check, the analysis will not be started.
	Abort	A message is displayed in the Audit Trail, and the running batch is aborted.

The table below lists the most frequently observed Dionex ICS-1600 error messages. For troubleshooting assistance, refer to the page indicated in the table.

Alarms and Error Conditions	See
Column heater exceeds safe temperature	page 63
Column heater open circuit	page 64
Column heater short circuit	page 64
Degas calibration failed	page 64
Hardware not present	page 64
Leak sensor wet	page 65
Load/Inject valve error	page 65
Option not installed	page 66
Pressure slope calibration error	page 66
Pump motor lost control	page 66
Pump over pressure	page 67
Pump pressure hardware error	page 66
Pump stopped due to lost USB communication error	page 68
Pump under pressure	page 68
Second valve error	page 68
Suppressor not connected	page 69
Suppressor over current	page 69
Suppressor over power	page 70
Suppressor over voltage	page 70
Suppressor stopped for zero flow rate	page 70

Table 4-2. Alarms and Error Messages Summary

4.2 Troubleshooting Error Messages

COLUMN HEATER EXCEEDS SAFE TEMPERATURE

This error occurs when the column heater temperature is higher than the maximum allowed. This error may occur if the Dionex ICS-1600 is operating in an extreme environment (greater than 40 °C (104 °F)).

To troubleshoot:

Refer to Section A.3 for environmental specifications.

COLUMN HEATER OPEN CIRCUIT

This error occurs when the column heater is unplugged from the component panel.

To troubleshoot:

1. Check that the column heater is plugged into the component panel.
2. If the error persists, the column heater may be faulty. Replace the column heater (see Section 5.12).

COLUMN HEATER SHORT CIRCUIT

This error occurs when there is a short circuit on the thermistor input used to measure the column heater temperature. This error indicates a faulty column heater.

To troubleshoot:

Replace the column heater (see Section 5.12).

DEGAS CALIBRATION FAILED

This error occurs when the degas vacuum does not reach the expected level during calibration.

To troubleshoot:

1. Retry the calibration.
2. If calibration still fails, the vacuum degas assembly may need to be replaced. Contact Thermo Fisher Scientific for assistance.

HARDWARE NOT PRESENT

This error indicates a problem in the Dionex ICS-1600 electronics.

To troubleshoot:

Contact Thermo Fisher Scientific for assistance. The Dionex ICS-1600 electronics components cannot be serviced by the user.

LEAK SENSOR WET

The leak sensor is installed in the drip tray at the bottom of the component panel (see Figure 2-8). If liquid accumulates in the tray, the sensor signals the problem and this error message appears.

To troubleshoot:

1. Locate the source of the leak by visually inspecting the tubing, fittings, and components on the component panel. Refer to Section 4.3.
2. Tighten fittings or replace tubing and fittings as required. Refer to Section 4.3 for detailed troubleshooting of various types of leaks.
3. After fixing the leak, dry the drip tray thoroughly to prevent the leak sensor from triggering additional error messages.

LOAD/INJECT VALVE ERROR

If the injection valve fails to switch position within 1 second of being toggled, the Dionex ICS-1600 Moduleware reports an error to Chromeleon and this error message appears.

To troubleshoot:

1. If a sequence is being executed, terminate the sequence by selecting **Batch > Stop** in Chromeleon.
2. Try to toggle the valve from Load to Inject by clicking the **Load** and **Inject** buttons on the Dionex ICS-1600 Control panel in Chromeleon or on the touch screen **HOME** page.
3. Turn off the Dionex ICS-1600 power briefly and then restart.
4. If the problem persists, repeat Step 2.
5. If the problem persists, contact Thermo Fisher Scientific for assistance.

OPTION NOT INSTALLED

This error occurs if a command is issued to control an option that is not installed.

To troubleshoot:

Check the Chromeleon Server Configuration program to verify that the option is enabled.

PRESSURE SLOPE CALIBRATION ERROR

This error occurs if you try to calibrate the pressure slope when the pressure is less than 3 MPa (500 psi).

To troubleshoot:

Contact Thermo Fisher Scientific for assistance.

PUMP MOTOR LOST CONTROL

This error indicates a problem in the pump controller electronics.

To troubleshoot:

Contact Thermo Fisher Scientific for assistance. The Dionex ICS-1600 electronics components cannot be serviced by the user.

PUMP PRESSURE HARDWARE ERROR

This error indicates a problem in the pump controller electronics.

To troubleshoot:

Contact Thermo Fisher Scientific for assistance. The Dionex ICS-1600 electronics components cannot be serviced by the user.

PUMP OVER PRESSURE

If the system pressure exceeds the set limit for at least 0.5 second, this error message appears and the pump stops. Pressure limits can be set in the Chromeleon Server Configuration or in the control program. The limits can also be set on the touch screen **PUMP** page (see Section B.7.1).

To troubleshoot:

1. Check for blockages in the liquid lines by working your way backward from the cell to the pump. See Section 2.2 for the system flow schematics.
2. Check that the flow rate is set to the correct value.
3. Check that the high pressure limit is set to the correct value.
4. Restart the pump.

PUMP STOPPED DUE TO LOST USB COMMUNICATION ERROR

This error occurs if the Dionex ICS-1600 loses communication with Chromeleon.

To troubleshoot:

Verify that the USB cable is connected correctly from the Dionex ICS-1600 rear panel to the Chromeleon PC.

PUMP UNDER PRESSURE

If the system pressure falls below the low pressure limit, the pump stops and this error message appears. Pressure limits can be set in the Chromeleon Server Configuration or in the control program. The limits can also be set on the touch screen **PUMP** page (see Section B.7.1).

To troubleshoot:

1. Make sure the eluent reservoir is full.
2. Check for liquid leaks (see Section 4.3).
3. Check that the waste valve is closed.
4. Prime the pump (see Section 5.16).
5. Restart the pump.

SECOND VALVE ERROR

If the auxiliary valve fails to switch position within 1 second of being toggled, the Dionex ICS-1600 Moduleware reports an error to Chromeleon and this error message appears.

To troubleshoot:

1. If a sequence is being executed, terminate the sequence by selecting **Batch > Stop** in Chromeleon.

2. Try to toggle the valve from position A to position B by clicking the corresponding buttons on the Dionex ICS-1600 Control panel in Chromeleon (or by clicking the **Valve_2** commands under **Pump_ECD** in the Commands dialog box).
3. Turn off the Dionex ICS-1600 power briefly and then restart.
4. If the problem persists, repeat Step 2.
5. If the problem persists, contact Thermo Fisher Scientific for assistance.

SUPPRESSOR NOT CONNECTED

This error occurs if you turn on the suppressor and the Dionex ICS-1600 cannot establish a connection with the suppressor.

To troubleshoot:

1. Check the suppressor cable connection (see Section 5.11).
2. If the error persists, contact Thermo Fisher Scientific for assistance. There may be a problem in the suppressor controller electronics. The Dionex ICS-1600 electronics components cannot be serviced by the user.

SUPPRESSOR OVER CURRENT

This error may be caused by an expended or dirty suppressor or by a malfunction in the suppressor controller electronics.

To troubleshoot:

1. Follow the instructions in the suppressor manual to regenerate the suppressor. Suppressor manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).
2. Follow the instructions in the suppressor manual to clean the suppressor.
3. If a malfunction in the suppressor controller is suspected, contact Thermo Fisher Scientific for assistance. The Dionex ICS-1600 electronics components cannot be serviced by the user.

SUPPRESSOR OVER POWER

This error occurs when, in order to maintain the selected current, the Dionex ICS-1600 is required to apply a higher voltage than the suppressor can support.

To troubleshoot:

1. Reduce the flow rate.
2. Rehydrate the suppressor. Refer to the suppressor manual for instructions. Suppressor manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).
3. If the error persists, replace the suppressor (see Section 5.11).

SUPPRESSOR OVER VOLTAGE

This error occurs if you turn on the suppressor but the Dionex ICS-1600 cannot establish a connection with the suppressor.

To troubleshoot:

1. Check the suppressor cable connection (see Section 5.11).
2. If the error persists, replace the suppressor (see Section 5.11).

SUPPRESSOR STOPPED FOR ZERO FLOW RATE

This error message appears when you click the **Shutdown** button on the Dionex ICS-1600 Control panel in Chromeleon. The message also appears anytime you turn off the pump flow while the suppressor is on. The suppressor is automatically turned off to prevent damage to the suppressor.

To troubleshoot:

- If the pump stopped unexpectedly, see Section 4.6 for pump troubleshooting information.

4.3 Liquid Leaks

- **Leaking fitting**

  Locate the source of the leak. Tighten or, if necessary, replace the liquid line connection (see Section 5.3). Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is included on the Thermo Scientific Reference Library DVD (P/N 053891).

- **Broken liquid line**

  Replace the line and fittings with the same length and internal diameter tubing (see Section 5.3).

- **Blocked or improperly installed line**

  Make sure the lines are not crimped or otherwise blocked. Also, if the blocked line is a waste line, make sure it is not elevated at any point after it exits the Dionex ICS-1600. If a line is blocked, replace it (see Section 5.2).

- **Loose pump check valve**

  1. Make sure the check valves are firmly seated in the pump head. If they are not, tighten them carefully with an open-end wrench just until the leak stops.
  2. If the leak persists, replace the check valve (see Section 5.6).

- **Leaking seal wash port**

  Leaking from the seal wash port indicates a leaking piston seal. Replace the seal (see Section 5.7).

- **Damaged pump piston seal**

  1. Replace the piston seal (see Section 5.7).
  2. If the leak persists, replace the piston (see Section 5.8).

- **Pump head not tight against casting**

  Carefully tighten the pump head mounting nuts just until the leak stops. **DO NOT OVERTIGHTEN!**

- **Leaking pressure transducer**

  1. Make sure the liquid line connections into the pressure transducer are tight. Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is included on the Thermo Scientific Reference Library DVD (P/N 053891). Replace any damaged fittings.
  2. If the pressure transducer continues to leak, contact Thermo Fisher Scientific for assistance. The pressure transducer cannot be serviced by the user.

- **Leaking pump head waste valve**

  Make sure the waste valve is closed. To close the valve, turn the knob clockwise, and tighten fingertight. **DO NOT OVERTIGHTEN! Overtightening may damage the valve and the pump head.**

  If the leak persists, replace the waste valve O-ring (see Section 5.9).

- **Leaking suppressor**

  Refer to the suppressor manual for troubleshooting procedures. Suppressor manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).

- **Leaking injection valve or auxiliary valve**

  1. Make sure the liquid line connections to the transducer are tight. Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is included on the Thermo Scientific Reference Library DVD (P/N 053891). Replace any damaged fittings.
  2. Liquid leaks from behind the valve stator may indicate a scratched rotor seal. Rebuild the valve (see Section 5.4).

- **Leaking detector cell**

  1. Check the waste lines for blockage; trapped particles can plug the lines and cause a restriction and/or leak. If necessary, clear the waste lines by reversing the direction of flow.
  2. Make sure the plumbing downstream from the cell is clear; a blockage may overpressurize the cell, causing it to leak. If the problem continues, contact Thermo Fisher Scientific for assistance.

4.4 Pump Difficult to Prime or Loses Prime

Excessive pressure fluctuations (more than 3% difference from one pressure reading to the next) indicate that the pump is out of prime.

- **Empty eluent reservoir and/or no eluent connected**

  Fill the reservoir. Make sure all connections are secure.

- **Eluent improperly or insufficiently degassed**

  If the Dionex ICS-1600 does not contain a vacuum degas assembly, degas the eluent manually (see Section 3.4.4).

  If the Dionex ICS-1600 contains a vacuum degas assembly, check the degas settings:

  1. Open the Chromeleon Server Configuration program. Right-click the Dionex ICS-1600 device in the timebase and select **Properties**.
  2. Select the **Options** tab (see Figure 4-1).

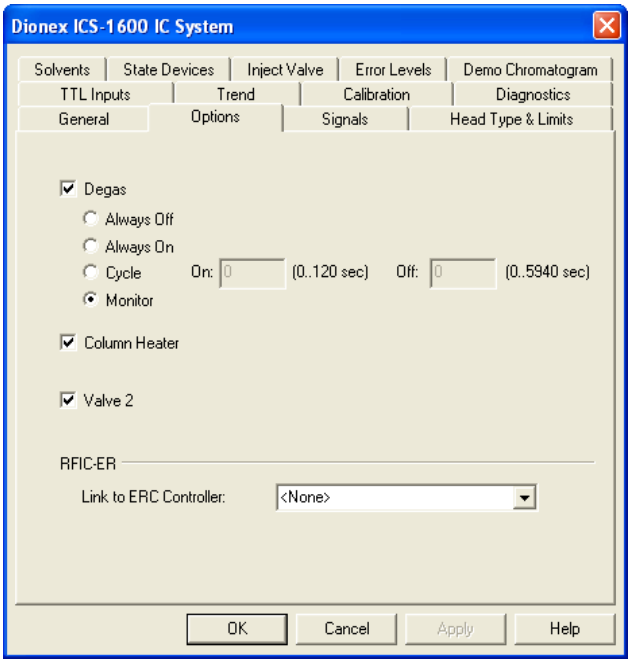


Figure 4-1. Dionex ICS-1600 Server Configuration Properties: Options

3. Verify that the **Degas** check box is selected.
4. Check the **Degas** settings. Select either the **Monitor** option or the **Cycle** option. If you select **Cycle**, set the time **On** to 30 seconds and the time **Off** to 600 seconds. If **Cycle** is already selected, try increasing the time on or decreasing the time off.

NOTE Degas options can also be selected from the touch screen PUMP page (see Section B.7).

- **End-line filter is dirty or clogged**

  When new, end-line filters (P/N 045987) are pure white. If the system is in continuous operation, change the end-line filter weekly, or whenever it becomes discolored. Replace the filter more often if bacterial buildup is visible or if the eluent does not contain solvent.

  NOTE It is especially important to regularly replace end-line filters when using aqueous eluents, which may contaminate the filter with bacteria or algae. The bacterial buildup may not be visible.

- **Blockages in inlet tubing**

  Kinked or clogged tubing causes the pump to be “starved” for eluent. Replace the tubing and fittings (see Section 5.3).

- **Dirty check valve**

  Clean or replace the pump check valve (see Section 5.6).

- **Liquid leaks at junction between pump head and pump casting**

  Use the open-end wrench (P/N 014605) provided in the Dionex ICS-1600 Ship Kit (P/N 067110) to tighten the two acorn nuts that attach the pump head to the pump housing (see Figure 5-12). Tighten the nuts evenly (12 in-lb torque).

  If the leak persists, replace the piston seal (see Section 5.7).

- **Liquid leaks from the seal wash port**

  Replace the piston seal (see Section 5.7).

- **Scratched pump piston**

  Check the pump pistons for scratches and replace if necessary (see Section 5.8).

4.5 Pump Does Not Start

- **No power (front Power LED indicator is not lit)**

  Check that the power cord is plugged in.

  Check the main power fuses and replace, if needed (see Section 5.18).

- **No communication between Dionex ICS-1600 and Chromeleon**

  Verify that the USB cable is connected correctly. For connection and setup information, refer to the Dionex ICS-1600 installation instructions.

- **Pump is turned off**

  Turn on the pump from either the Chromeleon Control panel or the Dionex ICS-1600 touch screen **HOME** page.

- **Flow rate is set to 0**

  Set the flow rate from either the Chromeleon Control panel or the Dionex ICS-1600 touch screen **HOME** page.

4.6 No Flow

- **Pump waste or priming valve open (see Figure 4-2)**

  Close the valves by turning the knobs clockwise until fingertight. **DO NOT OVERTIGHTEN! Overtightening may damage the valve and the pump head.**

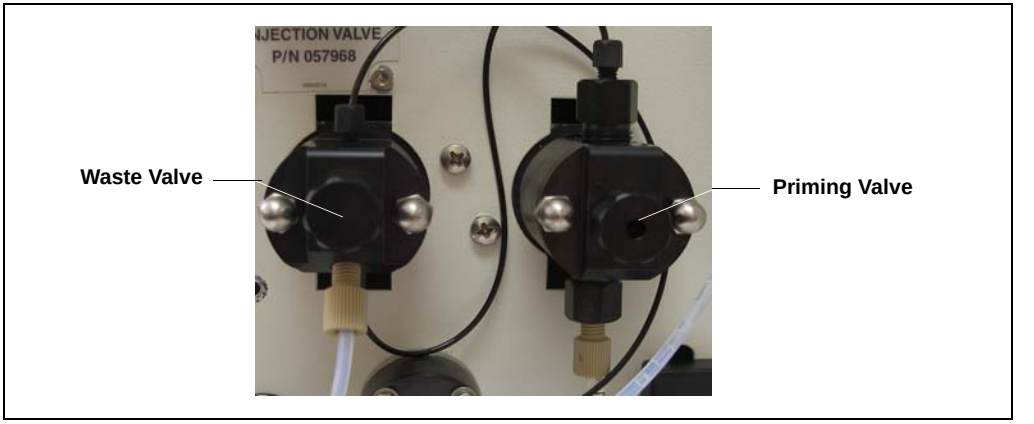


Figure 4-2. Waste and Priming Valves

- **Flow rate is set to 0**

  Set the flow rate from the Dionex ICS-1600 Control panel in Chromeleon or from the touch screen **HOME** page.

- **Eluent valve is closed**

  Open the eluent valve from the Dionex ICS-1600 Control panel in Chromeleon or from the touch screen **PUMP** page.

- **Pump not primed**

  Prime the pump (see Section 5.17).

- **Broken pump piston**

  Replace the piston (see Section 5.8).

4.7 Erratic Flow/Pressure Reading

- **Pump needs priming**

  Prime the pump (see Section 5.17).

- **Damaged piston seal**

  Replace the piston seal (see Section 5.7).

- **Dirty pump check valve**

  Clean or replace the check valve (see Section 5.6).

- **Leaking liquid lines or fittings**

  Check the liquid lines and fittings for small leaks. Tighten or, if necessary, replace the liquid line connection (see Section 5.3). Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is included on the Thermo Scientific Reference Library DVD (P/N 053891).

4.8 Excessive System Backpressure

- **Restriction in the system plumbing**

  Check all liquid lines for crimping or blockage. Make sure the ferrule fittings are not overtightened onto tubing. Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for details. The manual is included on the Thermo Scientific Reference Library DVD (P/N 053891).

  If you have trouble isolating the restriction, refer to Section 5.2.

- **Plugged or damaged fitting**

  Isolate the faulty fitting by loosening fittings, one by one, until the pressure returns to normal. Repair or replace the fitting (see Section 5.3).

- **Flow rate through the columns too high**

  Set the correct rate for your application. If an incorrect flow rate calibration is suspected, calibrate the flow (see Section 5.1.4).

- **Clogged column bed supports**

  Refer to the instructions in the column manual for troubleshooting guidance. Column manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).

- **Contaminated columns**

  Clean the columns as instructed in the column manual or replace the guard column.

- **Plugged injection valve or auxiliary valve passages**

  Rebuild the valve (see Section 5.4).

4.9 Peak "Ghosting"

"Ghosting" is the appearance of extraneous peaks in a chromatogram. These may be late-eluting peaks from a previous injection. They may also be the result of a contaminated standard or eluent, or a malfunctioning injection valve. These peaks may co-elute with peaks of interest, resulting in nonreproducible peak heights/areas.

- **Insufficient time between sample injections**

  Wait until the previous sample has been completely eluted before making another injection.

- **Insufficient flush between samples**

  Flush the sample loop with at least 10 loop volumes of deionized water or sample between sample injections.

- **Incorrect or contaminated standards**

  Remake standards.

- **Incorrect or contaminated eluent**

  Remake the eluent.If the system is not operating in the RFIC-ER mode, refer to the instructions in the column manual. The manual is included on the Thermo Scientific Reference Library DVD (P/N 053891).

  If this is an RFIC-ER system, refer to the instructions in the manual provided in your RFIC-ER Installation Kit.

  Install or replace the end-line filter on the end of the deionized water line (see Section 3.4.3).

- **Malfunctioning injection valve or auxiliary valve**

  1. Rebuild the valve (see Section 5.4).
  2. If the valve leak persists, contact Thermo Fisher Scientific for assistance.

4.10 Nonreproducible Peak Height or Retention Time

- **Column overloading**

  Dilute the sample (see Section 3.9.3).

- **Liquid leaks**

  Locate and eliminate the leaks (see Section 4.3).

- **Incomplete or imprecise filling of the sample loop**

  1. Fill the sample loop until excess sample exits the waste line.
  2. Inspect the 1-cc syringe (P/N 016388) and replace if damaged.

- **Pump not primed properly**

  Prime the pump (see Section 5.17).

4.11 Abnormal Retention Time or Selectivity

- **Incorrect or contaminated eluent**

  Remake the eluent, using concentrated eluent and ASTM filtered, Type I (18-megohm) deionized water.

- **Contaminated or degraded sample**

  Take appropriate precautions when preparing and storing samples to prevent contamination and degradation (see Section 3.9).

- **Contaminated column**

  1. Clean the column as instructed in the column manual. Column manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).
  2. If cleaning is unsuccessful, replace the column.

4.12 No Cell Response

- **Cell not properly installed**

  Verify that the cell front cover is flush against the component panel. If necessary, tighten the two mounting screws. When the cell is correctly

installed and the screws tightened, an electronics connector on the cell plugs into a receptacle inside the Dionex ICS-1600.

- **No flow from pump**

  This condition has several possible causes; see Section 4.5 and Section 4.6 for details.

- **Cell electronics malfunctioning**

  Use the Chromeleon Wellness Panel diagnostics to test the electronics (see Section 5.1 and the Chromeleon Help for instructions). If the variance reading is outside the tolerance range (less than 1 µS), the electronics are malfunctioning. Contact Thermo Fisher Scientific for assistance. The Dionex ICS-1600 electronics cannot be serviced by the user.

4.13 High Cell Output

- **Background not suppressed by suppressor**

  Verify that the suppressor is turned on and the current is set to the correct value. Refer to the suppressor manual for additional troubleshooting guidance. Suppressor manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).

- **Sample concentration too high**

  Dilute the sample (see Section 3.9.3).

- **Wrong eluent**

  Check that you are using the correct eluent for your application.

  RFIC-ER systems only: Replace the RFIC-ER columns, if necessary. An Audit Trail message will inform you when a column is approaching the end of its useful life span. You can also check the life expectancy of the columns on the RFIC-ER Wellness panel.

- **Background conductivity not offset from conductivity reading**

  Before making an injection, allow the background conductivity to equilibrate, and then click **Autozero** on the Dionex ICS-1600Control panel in Chromeleon or the Dionex ICS-1600 touch screen **HOME** page.

- **Cell out of calibration**

  Recalibrate the cell (see Section 5.1.3).

4.14 Baseline Noise or Drift

- **Flow system leak; erratic baseline**

  Check all fittings and liquid lines for leaks. Tighten or, if necessary, replace all liquid line connections. Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is included on the Thermo Scientific Reference Library DVD (P/N 053891).

- **Trapped gases**

  Release any trapped gases in the cell by loosening the lines to and from the cell and then retightening them. Also loosen and retighten the fittings to and from the suppressor eluent ports.

- **Pump not properly primed**

  Prime the pump (see Section 5.17).

- **Contaminated or incorrect eluent**

  Remake the eluent, using concentrated eluent and ASTM filtered, Type I (18-megohm) deionized water.

  RFIC-ER systems only: Replace the RFIC-ER columns, if necessary. An Audit Trail message will inform you when a column is approaching the end of its useful life span. You can also check the life expectancy of the columns on the RFIC-ER Wellness panel.

- **Rapid changes in ambient temperature**

  Make sure the ambient temperature is between 4 and 40 °C (40 and 104 °F).

  Make sure air conditioning and heating vents are directed away from the Dionex ICS-1600 and the Dionex ICS-1600 front door is closed.

- **Insufficient system equilibration following changes to operating parameters; especially apparent when operating at high sensitivities**

  Allow a longer system equilibration time (up to 2 hours) before starting operation.

- **Incorrect suppressor operating conditions**

  Refer to the suppressor manual for troubleshooting information. Suppressor manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).

- **Cell above or below temperature**

  Contact Thermo Fisher Scientific for assistance.

- **Damaged piston seal**

  Replace the piston seal (see Section 5.7).

4.15 Vacuum Degas Assembly Does Not Run

- **Degas option not enabled in Chromeleon**

  1. Open the Chromeleon Server Configuration program. Right-click the Dionex ICS-1600 device in the timebase and select **Properties**.
  2. Select the **Options** tab (see Figure 4-3).

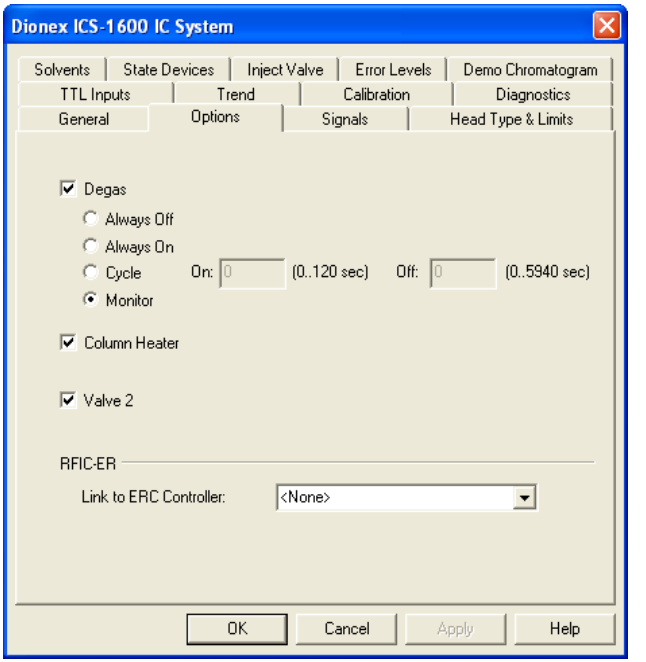


Figure 4-3. Dionex ICS-1600 Server Configuration Properties: Options

  3. Verify that the **Degas** check box is selected.

4. Under **Degas**, verify that the **Always Off** option is ***not*** selected. If it is, select one of the following settings instead:
   - **Cycle**; also select **On**: 30 seconds and **Off**: 10 minutes
   - **Monitor**
5. If the **Degas** settings are correct, but the degas assembly still does not run, test the assembly by selecting the **Always On** option. The pump should turn on immediately. If it does not, the vacuum degas assembly may need to be replaced. Contact Thermo Fisher Scientific for assistance.

NOTE **Degas options can also be selected from the touch screen PUMP page (see Section B.7).**

IMPORTANT **Select the Degas, Always On option only when testing the vacuum degas assembly. Do not select the Always On option for routine use.**

6. If the degas pump runs when you select **Always On**, but does not run when **Monitor** is selected, recalibrate the degas assembly (see Section 5.1.5).

5 • Service

This chapter describes Dionex ICS-1600 service and repair procedures that the user can perform. All procedures not included here, including electronics-related repair procedures, must be performed by Thermo Fisher Scientific personnel. For assistance, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

Before replacing any part, refer to the troubleshooting information in Chapter 4 to isolate the cause of the problem.

IMPORTANT **Substituting non-Dionex/Thermo Fisher Scientific parts may impair performance, thereby voiding the product warranty. Refer to the warranty statement in the Dionex Terms and Conditions for more information.**

5.1 Diagnostic and Calibration Procedures

Diagnostic and calibration procedures can be performed either from the touch screen or from the Chromeleon Wellness Panel (see Figure 5-1).

For an overview of the Wellness Panel features, see Section 5.1.1. For an overview of the diagnostic and calibration touch screen, see Section 5.1.2. For instructions on performing calibration and diagnostic procedures, see the following sections:

- Calibrating the Conductivity Cell (Section 5.1.3)
- Calibrating the Flow Rate (Section 5.1.4)
- Calibrating the Vacuum Degas Assembly (Section 5.1.5)

5.1.1 Chromeleon Wellness Panel Overview

NOTE Do not open a System Wellness Control panel if the name includes "Service.pan." These Wellness panels are reserved for use by Thermo Fisher Scientific Service Representatives.

To Open the Wellness Panel

1. In the Chromeleon Browser, expand the **Dionex Templates\Panels\Wellness** folder.
2. Double-click **ICS-1100_1600_2100_Wellness_user.pan**.

   The Wellness Panel opens (see Figure 5-1). If the controls on the Wellness panel are disabled, select **Control > Connect to timebase** and then select the Dionex ICS-1600 timebase.

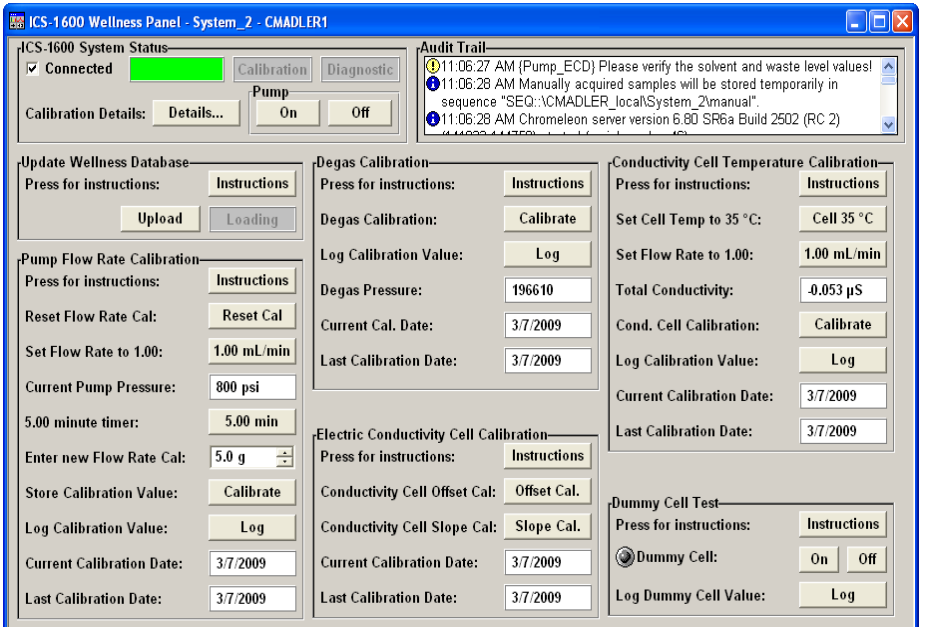


Figure 5-1. Chromeleon Wellness Panel

Use the Wellness Panel to perform the following functions:

- Calibrate the pump flow rate
- Calibrate the vacuum degas assembly
- Calibrate the conductivity cell
- Test the conductivity cell electronics, using a dummy cell
- Upload calibration values from the Dionex ICS-1600 to the Chromeleon Wellness database

IMPORTANT

After completing a calibration procedure from the touch screen, always update the Chromeleon Wellness database by clicking the Upload button on the Chromeleon Wellness Panel (see Figure 5-1). This action ensures that the current calibration information is stored in Chromeleon as well as in the Dionex ICS-1600.

5.1.2 Diagnostic and Calibration Touch Screen Overview

Select **DIAGNOSTIC** from the touch screen menu of pages. The **DIAGNOSTIC** page opens (see Figure 5-2). From there, you can access individual diagnostic and calibration pages.

NOTE The Service button provides access to service functions that are performed only by Thermo Fisher Scientific personnel. A code is required to access the service pages.

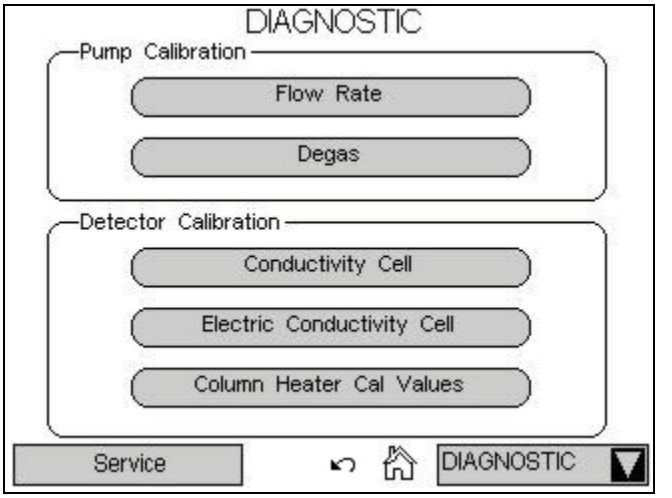


Figure 5-2. System Diagnostic Menu Page

5.1.3 Calibrating the Conductivity Cell

When to Calibrate

- After every 6 months of use

NOTE **Do not use this procedure to calibrate a new cell. If you are replacing a cell, see the instructions in Section 5.10 to install the new cell and calibrate it.**

Items Needed	Description
1.0 mM KCl solution	Prepare by dissolving 0.07456 g of reagent-grade KCl in 1 liter of 18-megohm DI water.
Backpressure tubing to provide at least 7 MPa (1000 psi)	Use 0.076-mm (0.003-in) ID yellow PEEK tubing (P/N 049715).

1. Open the Dionex ICS-1600 Wellness Panel in Chromeleon (see Section 5.1.1), or open the touch screen **ELECTRIC CONDUCTIVITY CALIBRATION** page (see Figure 5-3).

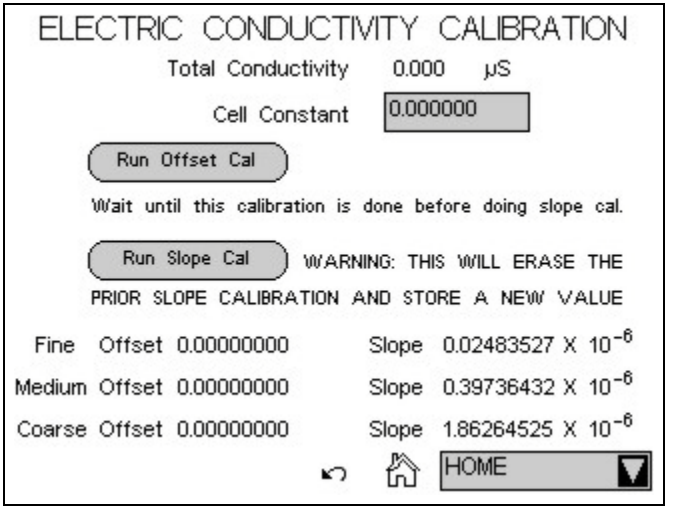

ELECTRIC CONDUCTIVITY CALIBRATION
Total Conductivity 0.000 µS
Cell Constant 0.000000
Run Offset Cal
Wait until this calibration is done before doing slope cal.
Run Slope Cal
WARNING: THIS WILL ERASE THE PRIOR SLOPE CALIBRATION AND STORE A NEW VALUE
Fine Offset 0.00000000 Slope 0.02483527 X 10-6
Medium Offset 0.00000000 Slope 0.39736432 X 10-6
Coarse Offset 0.00000000 Slope 1.86264525 X 10-6
HOME

Figure 5-3. Electric Conductivity Calibration Page

2. On the Wellness Panel under **Electric Conductivity Cell Calibration**, click **Offset Cal**, or touch **Run Offset Cal** on the Dionex ICS-1600 touch screen.
3. When the offset calibration is complete, click **Slope Cal** on the Wellness Panel, or touch **Run Slope Cal** on the Dionex ICS-1600 touch screen.
4. If you are using the Wellness Panel, click **Log** to record the new calibration values in the Audit Trail.
5. Disconnect the pump output line from the injection valve.
6. Disconnect the line from the suppressor **ELUENT OUT** port to the cell inlet and connect the pump output line directly to the cell inlet.
7. Disconnect the line from the suppressor **REGEN IN** port to the cell outlet. Direct the cell outlet line to a waste container.
8. Verify that the backpressure is at least 7 MPa (1000 psi).
9. If you are using the touch screens to perform the calibration, open the **CONDUCTIVITY CELL** page (see Figure 5-4).

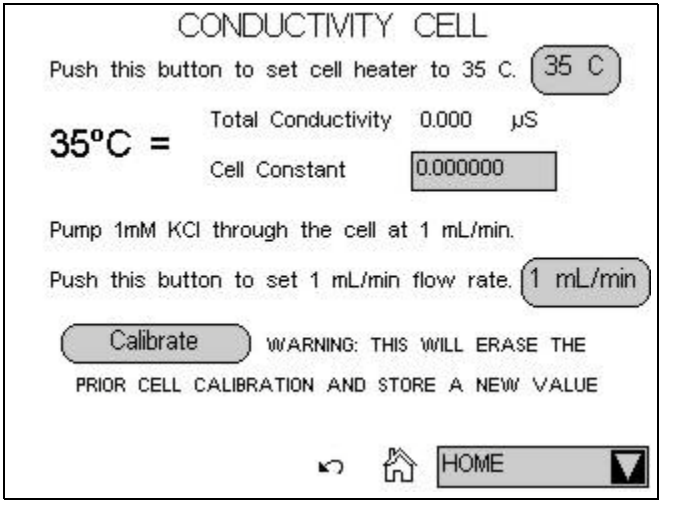

CONDUCTIVITY CELL
Push this button to set cell heater to 35 C.
35 C
35°C =
Total Conductivity 0.000 µS
Cell Constant
0.000000
Pump 1mM KCl through the cell at 1 mL/min.
Push this button to set 1 mL/min flow rate.
1 mL/min
Calibrate
WARNING: THIS WILL ERASE THE
PRIOR CELL CALIBRATION AND STORE A NEW VALUE
HOME

Figure 5-4. Conductivity Cell Page

10. On the Wellness Panel under **Conductivity Cell Calibration**, click **Cell 35 °C**, or touch **35 C** on the Dionex ICS-1600 touch screen. Allow the cell to reach this temperature, and then wait an additional 5

minutes to let it stabilize. When the temperature has stabilized, "=" is displayed to the right of the temperature reading on the **CONDUCTIVITY CELL** page.

11. Select **1.00 mL/min** to begin pumping 1.00 mM KCl through the cell at 1.0 mL/min.
12. Wait until the total conductivity reading stabilizes (in about 15 minutes) and then select **Calibrate** on the Wellness Panel or the touch screen **CONDUCTIVITY CELL** page.

    After calibration, the conductivity reading should be 147.00 ± 2 µS and the cell constant should be between 120 and 180. If this is not the case, contact Thermo Fisher Scientific for help.
13. If you are using the Wellness Panel, click **Log** to record the new calibration values in the Audit Trail.
14. If you are using the touch screen, record the new calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see Section 5.1.1) and click **Upload** under **Update Wellness Database**.
15. Flush the KCl solution from the system by pumping deionized water through the cell. When the conductivity drops to less than 1 µS/cm, stop the pump.
16. Reconnect the pump to the injection valve and reconnect the line from the suppressor **ELUENT OUT** port to the cell inlet.
17. Reconnect the cell outlet to the suppressor **REGEN IN** port.

5.1.4 Calibrating the Flow Rate

When to Calibrate

If you run the Dionex ICS-1600 Operational Qualification or Performance Qualification and it fails.

Items Needed

- 0.076-mm (0.003-in) ID yellow PEEK tubing (P/N 049715) to create 14 ± 2 MPa (2000 ± 300 psi) of backpressure (if needed)
- High purity ASTM filtered, Type I (18 megohm-cm) deionized water
- Balance capable of weighing more than 10 g with 0.001 g readability
- Tared beaker

To Calibrate

1. Open the Dionex ICS-1600 Wellness Panel in Chromeleon (see Section 5.1.1), or open the Dionex ICS-1600 touch screen **FLOW RATE** page (see Figure 5-5).

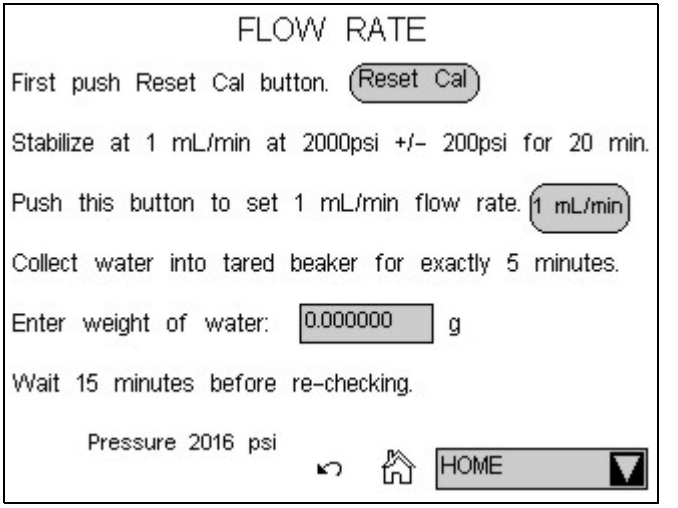

FLOW RATE
First push Reset Cal button.
Reset Cal
Stabilize at 1 mL/min at 2000psi +/- 200psi for 20 min.
Push this button to set 1 mL/min flow rate.
1 mL/min
Collect water into tared beaker for exactly 5 minutes.
Enter weight of water:
0.000000
g
Wait 15 minutes before re-checking.
Pressure 2016 psi
HOME

Figure 5-5. Flow Rate Page

2. Verify that there is 14 ± 1.4 MPa (2000 ± 200 psi) of backpressure.

3. On the Chromeleon Wellness Panel under **Pump Flow Rate Calibration**, select **Reset Cal**, or touch **Reset Cal** on the touch screen.
4. Select **1 mL/min** to set the flow rate and begin pumping deionized water.
5. Allow the pump to stabilize for 20 minutes.
6. If you are using the Wellness Panel, click **5.00 min** to start the timer. If you are using the touch screen, start an external timer. Immediately start collecting water into the tared beaker.
7. Collect the water for exactly 5.00 minutes.
8. Enter the weight of the water (in grams).
9. If you are using the Wellness Panel, click **Calibrate** to download the value to the Dionex ICS-1600.
10. To recheck the value, wait at least 15 minutes, and then repeat the calibration.
11. If you are using the Wellness panel, click **Log** to record the new calibration value in the Audit Trail.
12. If you performed the calibration from the Dionex ICS-1600 touch screen, record the new calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see Section 5.1.1) and click **Upload**.

5.1.5 Calibrating the Vacuum Degas Assembly

When to Calibrate

- After every 6 months of use

1. Open the Dionex ICS-1600 Wellness Panel in Chromeleon (see Section 5.1.1), or open the Dionex ICS-1600 touch screen **PUMP DEGAS** page (see Figure 5-6).

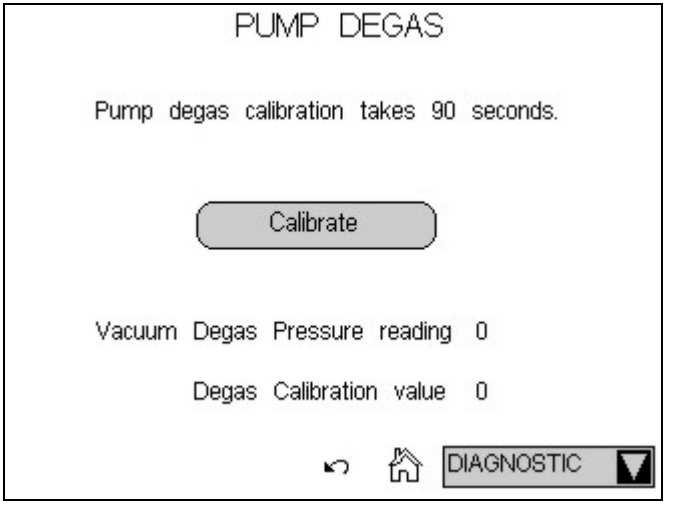


Figure 5-6. Pump Degas Page

2. On the Wellness Panel under **Degas Calibration**, select **Calibrate**, or touch **Calibrate** on the Dionex ICS-1600 touch screen. The degas pump runs for 90 seconds to allow a vacuum to be created. After 90 seconds, the vacuum degas pressure reading is recorded. When the vacuum degas assembly is running in monitor mode, this calibration value is used to determine when to turn on the degas pump.
3. If you are using the Wellness panel, click **Log** to record the new calibration value in the Audit Trail.
4. If you performed the calibration from the Dionex ICS-1600 touch screen, record the new calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see Section 5.1.1) and click **Upload** under **Update Wellness Database**.

5.2 Isolating a Restriction in the Liquid Lines

A restriction in the liquid plumbing will cause excessive system backpressure.

1. Begin pumping eluent through the system (including the columns).
2. Follow the flow schematics in Figure 5-7 or Figure 5-8 and work backward through the system, beginning at the suppressor **Regen Out** port. One at a time, loosen each fitting and observe the pressure. The connection at which the pressure drops abnormally indicates the point of restriction.

   NOTE The numbers on the flow schematics indicate the order in which liquid flows through the system components.

   If the restriction has caused such high pressure that the system cannot be operated, you must work forward through the flow schematic, adding parts one at a time until an abnormal pressure increase (and hence, the restriction) is found.
3. If the restriction is in the tubing or fitting, remove the restriction by back flushing or by replacing the tubing or fitting (see Section 5.3).

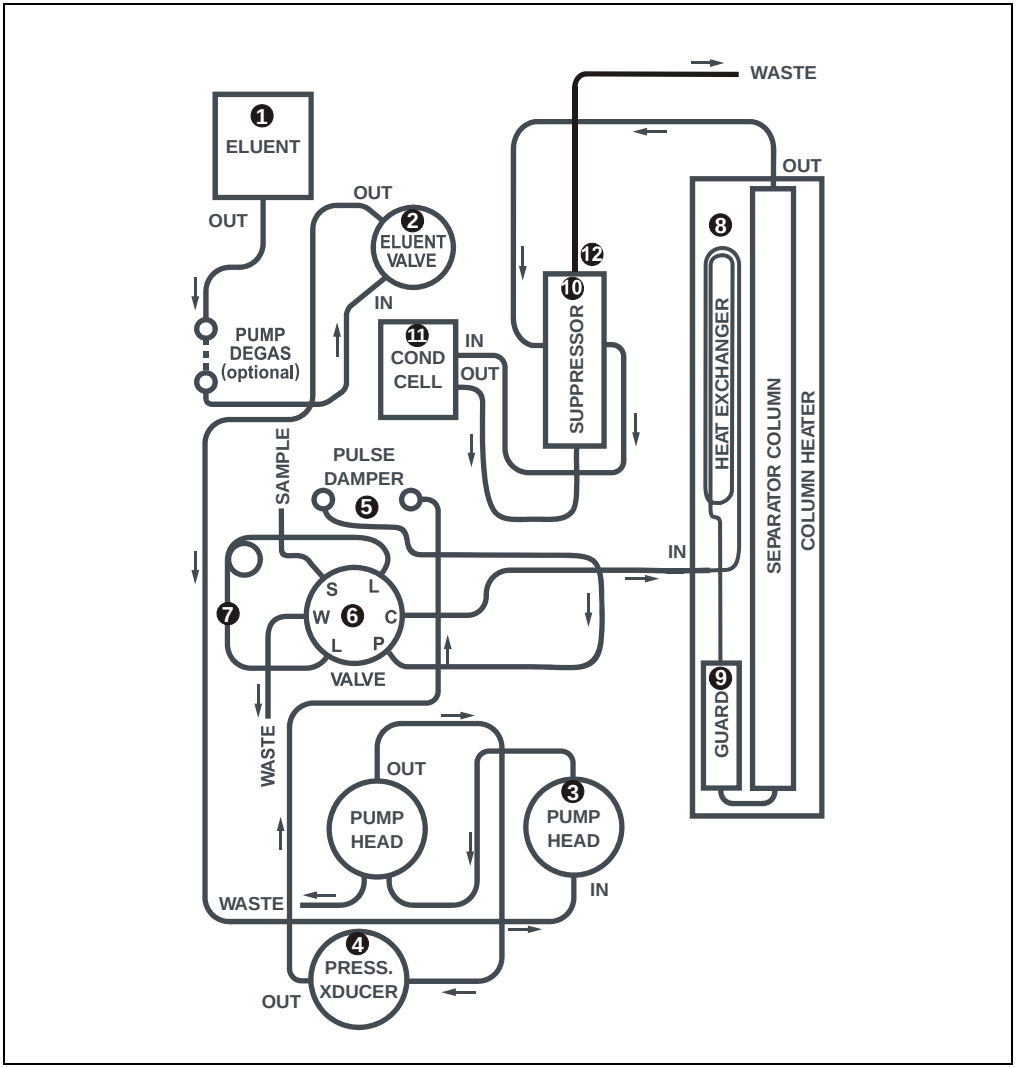


Figure 5-7. Dionex ICS-1600 Flow Schematic: Standard Configuration

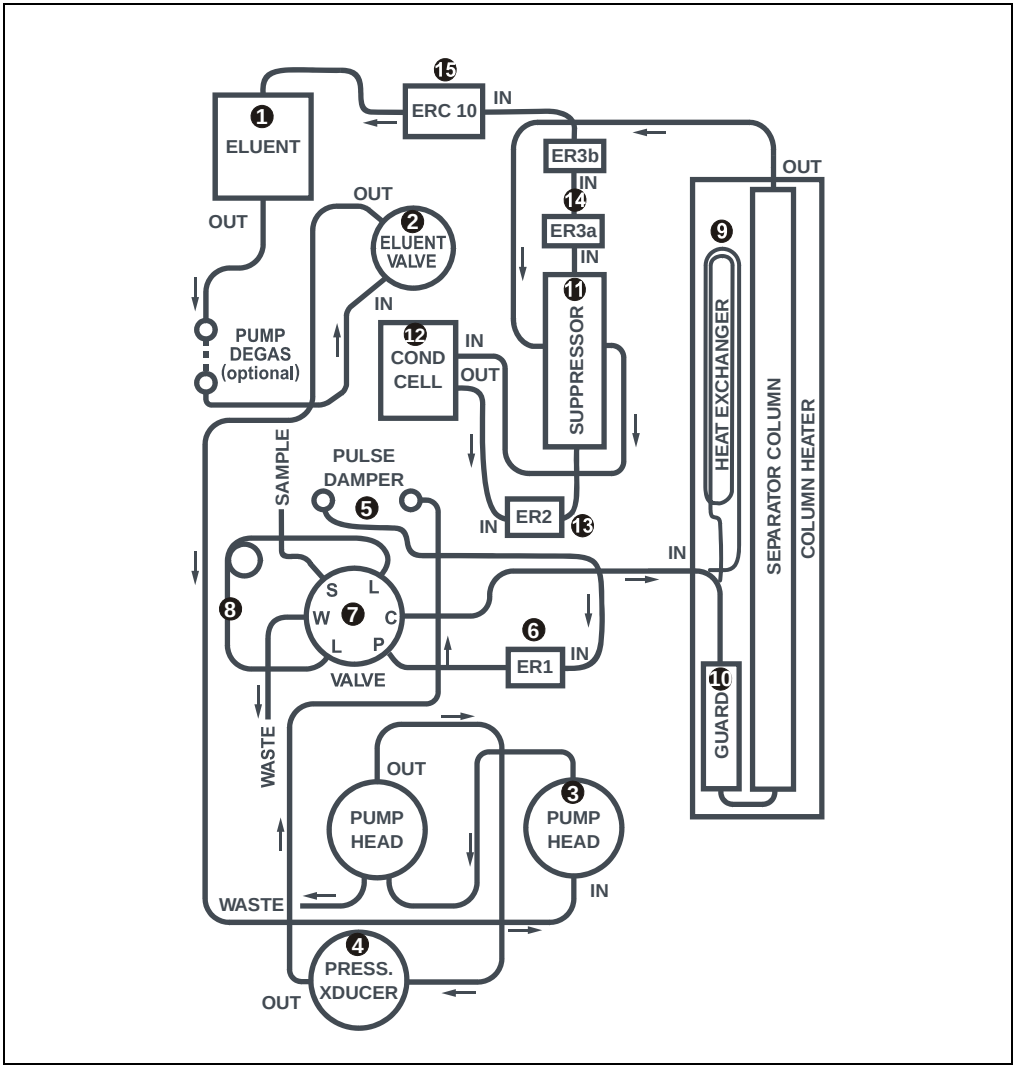


Figure 5-8. Dionex ICS-1600 Flow Schematic: RFIC-ER Mode

5.3 Replacing Tubing and Fittings

The Dionex ICS-1600 is plumbed with the tubing and tubing assemblies listed below.

Tubing Size and Type	Color	Used For
0.125-mm (0.005-in) ID PEEK (P/N 044221)	Red	Connection from pump pulse damper to pressure transducer
0.25-mm (0.010-in) ID PEEK (P/N 042690)	Black	Connections between other system components
0.50-mm (0.020-in) ID PEEK (P/N 042855)	Orange	Connection from injection port to injection valve
0.75-mm (0.030-in) ID PEEK (P/N 044777)	Green	Connection from injection valve to waste
1.58-mm (0.062-in) ID PTFE (P/N 014157)	Clear	Connection from pump to degas or eluent reservoir; pump waste
25 µL sample loop (P/N 042857)	Orange	Connection between ports **L (1)** and **L (4)** on the injection valve

- The ER Tubing Kit (P/N 070061) contains the four pieces of tubing required for connections from the RFIC-ER columns to the component panel. This tubing is initially installed in the Dionex ICS-1600 at the factory.
- 10-32 fittings (P/N 043275) and ferrules (P/N 043276) are used for most tubing connections. For tightening requirements, refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432). The manual is included on the Thermo Scientific Reference Library DVD (P/N 053891).
- 1/8-in fittings (P/N 052267) and ferrules (P/N 048949) are used for connections to the suppressor **REGEN OUT** port and the eluent reservoir.

5.4 Rebuilding the Injection Valve or Auxiliary Valve

Thermo Fisher Scientific recommends rebuilding the injection valve and the auxiliary valve (if installed) annually. The Injection Valve Rebuild Kit (P/N 057896) contains all required replacement parts for one valve.

NOTE **If you prefer, you can replace the auxiliary valve "pod," instead of rebuilding the valve. Replacing the pod is easier and faster than rebuilding the auxiliary valve. For instructions, see Section 5.5.**

IMPORTANT **Substituting non-Dionex/Thermo Fisher Scientific parts may impair performance, thereby voiding the product warranty. Refer to the warranty statement in the Dionex Terms and Conditions for more information.**

1. Turn off the pump from the Dionex ICS-1600 Control panel in Chromeleon or from the touch screen **HOME** page.
2. Open the Dionex ICS-1600 front door.
3. Disconnect each liquid line connected to the valve.
4. Follow the instructions provided in the Rebuild Kit to replace the rotor seal, isolation seal, and stator face.
5. Reconnect all liquid lines to the injection valve (see Figure 5-9) or auxiliary valve.
6. Close the door.
7. Turn on the pump.

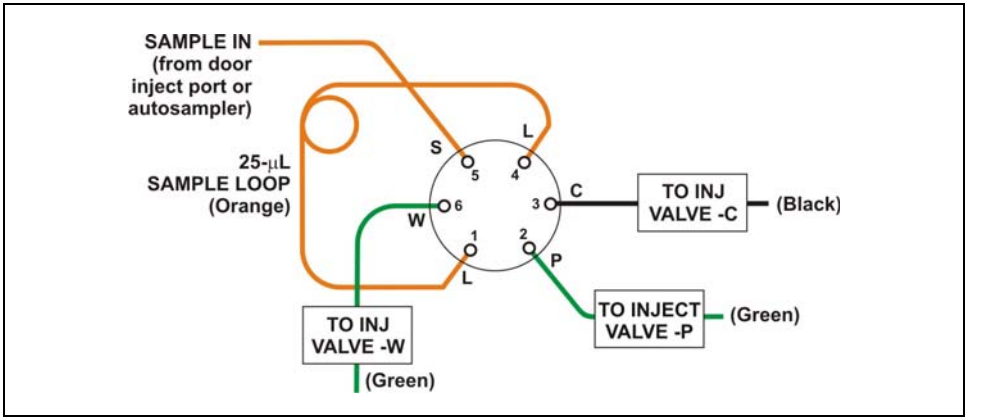


Figure 5-9. Injection Valve Plumbing

5.5 Replacing an Auxiliary Valve Pod

This procedure describes how to replace the mechanical part (the "pod") of the optional auxiliary valve. This procedure is an alternative to rebuilding the valve (see Section 5.4).

NOTE If the valve electronics require service, contact Thermo Fisher Scientific. Electronics-related repair procedures must be performed by Thermo Fisher Scientific personnel.

IMPORTANT **Substituting non-Dionex/Thermo Fisher Scientific parts may impair performance, thereby voiding the product warranty. Refer to the warranty statement in the Dionex Terms and Conditions for more information.**

1. Turn off the pump flow from the Dionex ICS-1600 Control panel in Chromeleonor from the touch screen **HOME** page.
2. Open the Dionex ICS-1600 front door.
3. Disconnect each liquid line connected to the valve.

4. Unscrew the black locking ring on the front of the valve (see Figure 5-10) and remove the ring.
5. Grasp the front of the valve pod and pull firmly to remove it from the Dionex ICS-1600.

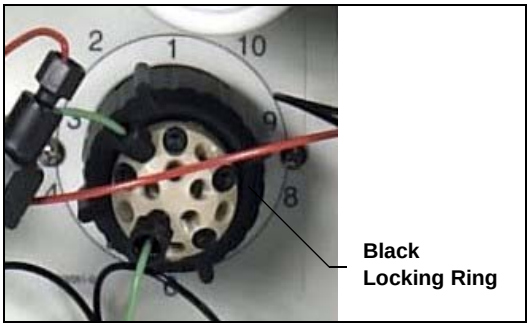


Figure 5-10. Unscrew the Valve Locking Ring

6. Check that the new pod (6-port, P/N 061947; 10-port, P/N 061948) has the correct number of ports for the valve being serviced.
7. Align the slots in the new pod with the runner in the valve holder on the Dionex ICS-1600 (see Figure 5-11). Valve pods are keyed to fit only one way (one slot is narrower than the other). Verify that the slots are aligned with their matching runners.
8. Also verify that the two splines on the pod align with the matching splines inside the valve holder (see Figure 5-11). If necessary, twist the end of the pod to adjust the position of the splines.

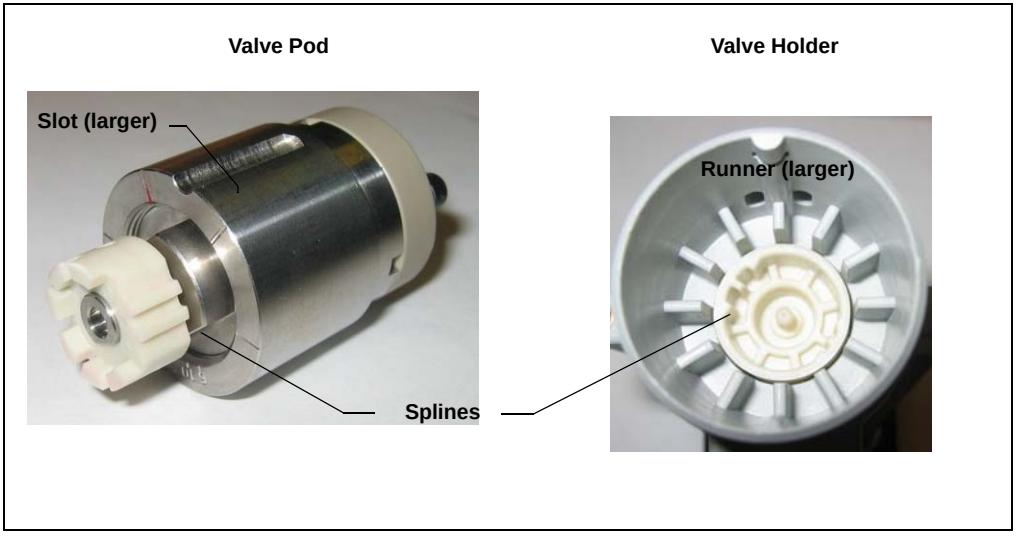


Figure 5-11. Valve Pod and Pod Holder

9. Push the pod into the holder until it clicks into place. Replace the black locking ring.
10. Reconnect all liquid lines to the valve.
11. Turn on the pump flow. Check for leaks from the valve. Tighten fittings as required (see Section 5.1.1).
12. Close the door.

5.6 Cleaning and Replacing the Pump Check Valves

A dirty check valve causes erratic flow rates and pressures. In addition, it may cause the pump to lose prime and/or be difficult to reprime. If possible, replace dirty check valves. If new check valves are not available, follow the instructions for cleaning.

Replacing Check Valves

1. Close the eluent valve from the Dionex ICS-1600 Control panel in Chromeleon or select **Eluent Valve Closed** on the touch screen **PUMP** page.
2. Turn off the main power switch, to ensure that you do not unintentionally start the Dionex ICS-1600.
3. To prevent contamination of pump parts, put on a pair of rubber gloves before disassembling the pump head.
4. Disconnect the tube fittings from the inlet and outlet check valve assemblies on the primary pump head (see Figure 5-12).
5. Use a 1/2-inch wrench to loosen both check valve assemblies. Remove the check valve assemblies from the pump head.

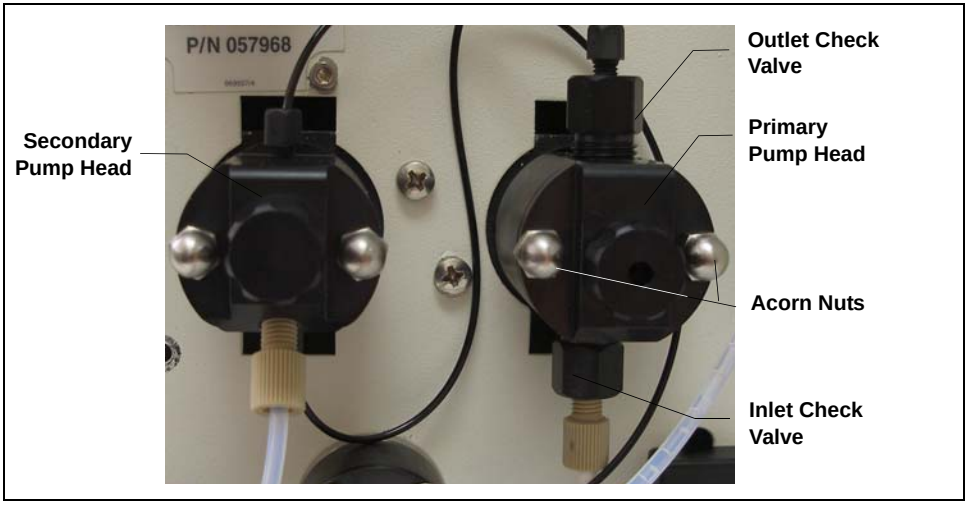
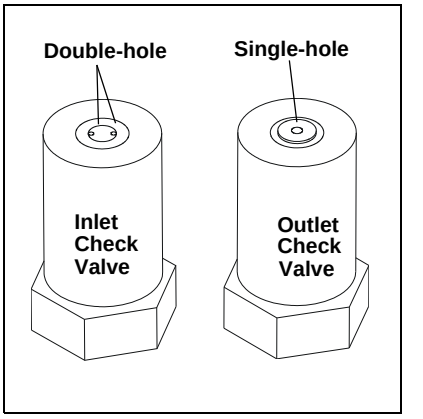


Figure 5-12. Pump Heads

NOTE The *inlet* check valve assembly housing has a 1/4-28 port. The *outlet* check valve assembly housing has a 10-32 port.

6. If you are installing new cartridges (P/N 045994) in the existing check valve housings, place the cartridge in the *inlet* check valve housing with the double-hole end of the cartridge visible and place the cartridge in the *outlet* housing with the single-hole end visible.



NOTE The pump will not operate properly unless the cartridge is installed in the housing in the correct orientation. Liquid flows through the check valve in the large single hole and out the small double holes.

7. Install the inlet check valve assembly (P/N 045722) on the bottom of the primary pump head. Install the outlet check valve assembly (P/N 045721) on the top of the head. Tighten the check valves fingertight, and then use a wrench to tighten an additional one-quarter to one-half turn.

IMPORTANT **Overtightening may damage the pump head and check valve housing and crush the check valve seats.**

8. Reconnect the liquid lines. Turn on the Dionex ICS-1600 main power.
9. Open the eluent valve from the Dionex ICS-1600 Control panel in Chromeleon or select **Eluent Valve Closed** on the touch screen **PUMP** page.
10. Prime the pump (see Section 5.17).
11. When the Dionex ICS-1600 is at operating pressure, check for leaks from the check valves. Tighten a check valve a *little more* only if it leaks.

Cleaning Check Valves

1. Carefully remove the check valve cartridges from the valve housings.
2. Place the check valve housings and cartridges in a beaker with methanol. Sonicate or agitate the parts for several minutes.
3. Rinse each check valve housing and cartridge thoroughly with filtered deionized water.
4. To reinstall the check valves and complete the procedure, see Step 6 through Step 11 above.

5.7 Replacing a Pump Piston Seal and Piston Rinse Seal

A damaged seal allows leakage past the piston, as well as leakage from the piston seal wash housing. The pump may be difficult to prime, flow rates may be unstable, and there may be baseline noise.

Preparation

1. Rinse the pump flow path with deionized water. Direct the flow to waste by opening the waste valve on the secondary pump head (see Figure 5-15). To open the valve, turn the knob one-quarter to one-half turn counterclockwise.
2. After rinsing, close the waste valve.
3. Close the eluent valve from the Dionex ICS-1600 Control panel in Chromeleon or select **Eluent Valve Closed** on the touch screen **PUMP** page.
4. To prevent contamination of pump parts, put on a pair of rubber gloves before disassembling the pump head.

Removing the Head and Piston

1. Turn off the main power switch, to ensure that you do not unintentionally start the Dionex ICS-1600.
2. Disconnect all tubing connections to the pump head.
3. Locate the open-end wrench (P/N 014605) provided in the Dionex ICS-1600 Ship Kit (P/N 067110). Use the wrench to remove the two acorn nuts (see Figure 5-12) from the pump head.
4. Slowly pull the head and allow it to separate from the housing. Carefully disengage the head from the piston by pulling the head straight off and away from its mounting studs.

Lateral motion while disengaging the pump head from the piston may break the piston.

Un mouvement latéral pendant la séparation de la tête et du piston peut casser le piston.

Vermeiden Sie Seitwärtsbewegungen, wenn Sie den Kopf vom Kolben lösen. Andernfalls kann der Kolben brechen.

5. Place the head (front end down) on a clean work surface and lift off the spacer to expose the piston seal (see Figure 5-13 or Figure 5-14).

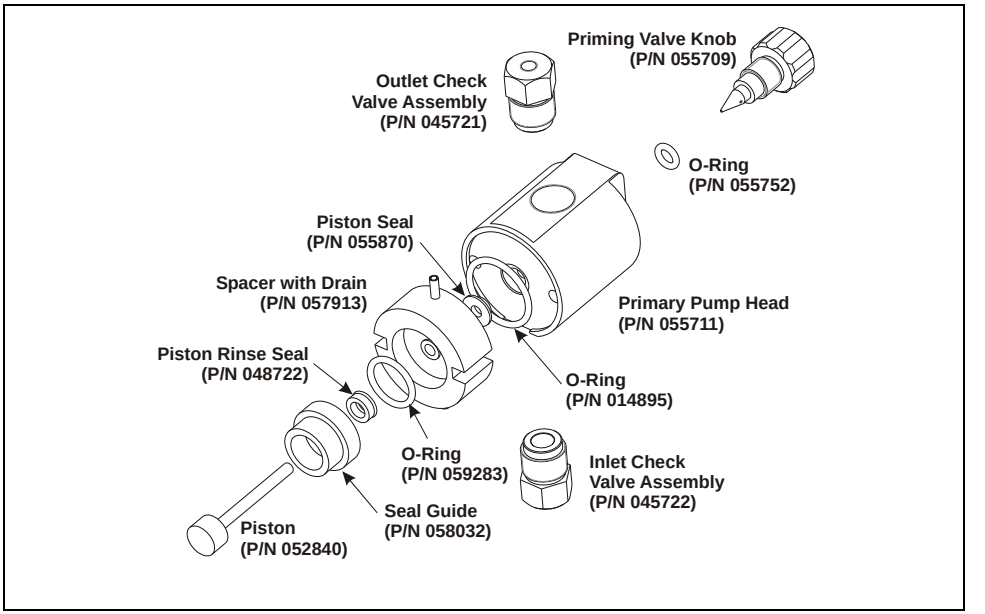


Figure 5-13. Primary Pump Head

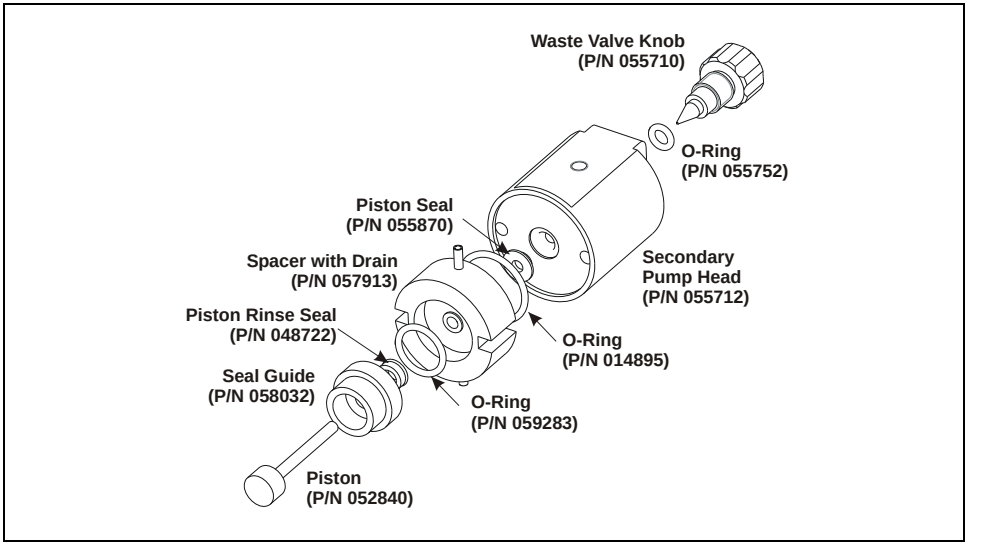
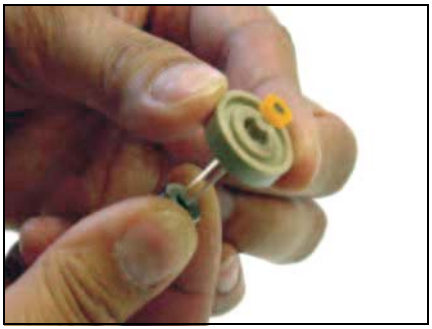


Figure 5-14. Secondary Pump Head

6. The piston does not come off as part of the pump head assembly because it is captured by a magnetic retention system. After removing the pump head, hold the shaft of the piston (near the base), tilt the piston slightly, and pull the piston away from the pump.

Installing the New Piston Rinse Seal

1. Remove the guide from the spacer to expose the piston rinse seal and O-ring. Remove the O-ring.
2. Remove the old piston rinse seal from the guide as follows:
   a. Hold the guide with the flat side facing up.
   b. To dislodge the piston rinse seal, gently insert the shaft of the piston through the small hole in the center of the guide (see photo).
   c. Pull the seal off the end of the piston shaft and remove the piston from the guide.



3. Hold the new piston rinse seal (P/N 048722) with the grooved side facing up.
4. Using your fingertip, gently press the piston rinse seal into the guide until the edge of the seal is below the surface of the guide.

IMPORTANT **The piston rinse seal is made of soft plastic. Do not press on the seal with anything hard or sharp, including your fingernail. If the seal is nicked or gouged, it will not seal properly and may result in leaks.**

5. Place the new O-ring (P/N 059283) into the groove in the guide.
6. Remove the O-ring from the groove in the flat side of the spacer and replace it with the new O-ring (P/N 014895).
7. In one hand, hold the guide with the O-ring and piston rinse seal facing up (this prevents the O-ring from falling out). In the other hand, hold the spacer with the cavity facing down.
8. Gently press the guide into the cavity in the spacer until it is fully seated.

Removing the Piston Seal from the Head

1. Fill the head cavity with deionized water by injecting the liquid through either the piston opening or the inlet check valve.
2. Reinsert the piston approximately 3 mm (0.125) inch into the seal.
3. If this is the *primary* pump head, install a 10-32 fitting plug (P/N 042772) on the outlet check valve. Tighten the plug.
4. If this is the *secondary* pump head, install a 10-32 fitting plug (P/N 042772) in both the inlet and outlet ports. Tighten the plugs.
5. Push the piston into the head. (This should hydraulically unseat the seal from the head.) Remove the piston and pull off the seal.

   NOTE If the piston seal is not removed, make sure the 10-32 fitting plug(s) are tight and add more water. Make sure the head contains no air bubbles, and then repeat Step 2 and Step 5.

6. Remove the 10-32 fitting plug(s).

Installing the New Piston Seal

1. Open the priming valve knob (primary pump head) or waste valve knob (secondary pump head) by turning the knob one-quarter to one-half turn counterclockwise.
2. Push the piston through the spacer and then through the new seal. Insert the piston and seal into the pump head until the seal makes contact with the bottom of the counterbore.

   NOTE If necessary, lubricate the seal with a small amount of isopropyl alcohol to facilitate insertion.

3. To seat the seal, push down on the spacer until it is flush with the head. A clicking sound indicates that the seal is correctly seated.
4. Close the priming valve knob or waste valve knob.

Reinstalling the Head and Piston

Thermo Fisher Scientific recommends reinstalling the head and piston as a single assembly, so that the piston centers itself onto the magnetic follower.

1. Hold the assembled spacer and guide with the drain tubes aligned vertically and press the spacer into the head until it is flush with the indented surface of the head.
2. Insert the piston so that 1/4 inch of the shaft is exposed. This ensures that the magnet in the follower picks up the piston. (The follower is the cylinder that holds the piston in place as it moves in and out of the pump head assembly.)
3. Reinstall the head and piston assembly; use a wrench to tighten the nuts evenly (12 in-lb torque).

Completing the Procedure

1. Reconnect all liquid lines to the pump head.
2. Turn on the main power switch.
3. Open the eluent valve.
4. Prime the pump (see Section 5.17).

5.8 Replacing a Pump Piston

Continued leaking of the piston seal after installation of a new seal (assuming the pump head is tight) indicates a dirty, scratched, or broken piston.

Follow the instructions in Section 5.7 to install a new piston (P/N 052840) and piston seal (P/N 055870).

5.9 Replacing the Waste Valve or Priming Valve O-Ring

A damaged O-ring causes leakage around the base of the waste valve or priming valve knob.

1. Close the eluent valve from the Dionex ICS-1600 Control panel in Chromeleon or select **Eluent Valve Closed** on the touch screen **PUMP** page.
2. Turn off the main power switch, to ensure that you do not unintentionally start the Dionex ICS-1600.
3. To remove the waste valve or priming valve from the pump head (see Figure 5-15), turn the knob counterclockwise until it is loose, and then pull the knob straight out of the cavity in the pump head.

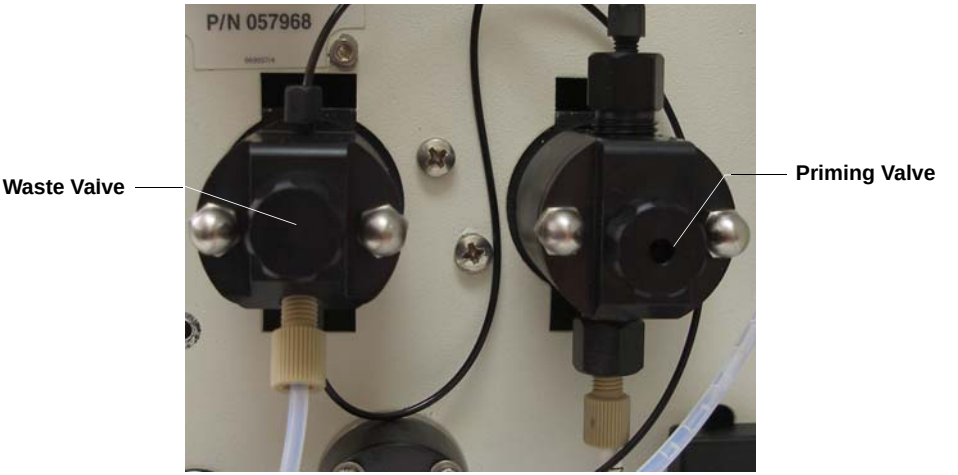


Figure 5-15. Waste and Priming Valves

4. If the O-ring is removed with the valve knob in Step 3, pull the O-ring off the end of the knob (see Figure 5-16). If the O-ring is not removed with the valve knob, insert a thin object (for example, the bent end of a paper clip) into the cavity in the pump head and carefully pull out the O-ring. **Do not scratch the cavity.**

IMPORTANT **Scratches in the cavity will cause leaks around the base of the knob while the pump is being primed.**

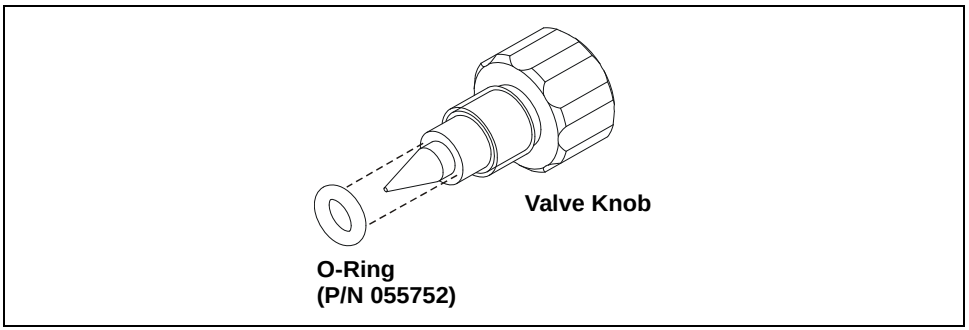


Figure 5-16. Waste Valve or Priming Valve O-Ring Replacement

5. Slide a new O-ring (P/N 055752) over the end of the valve.
6. To reinstall the valve containing the new O-ring, turn the knob clockwise and then tighten fingertight.

NOTE **It is normal to encounter resistance after several rotations of the knob; the O-ring is being pushed into the cavity of the pump head.**

7. Turn on the main power switch.
8. Open the eluent valve.
9. Prime the pump (see Section 5.17).

5.10 Replacing the Conductivity Cell

1. Turn off the Dionex ICS-1600 power.
2. Open the front door and disconnect the tubing from the **CELL IN** and **CELL OUT** fittings (see Figure 5-17, View A). Loosen the two screws on the cell front cover. The screws remain attached (see Figure 5-17, View B).

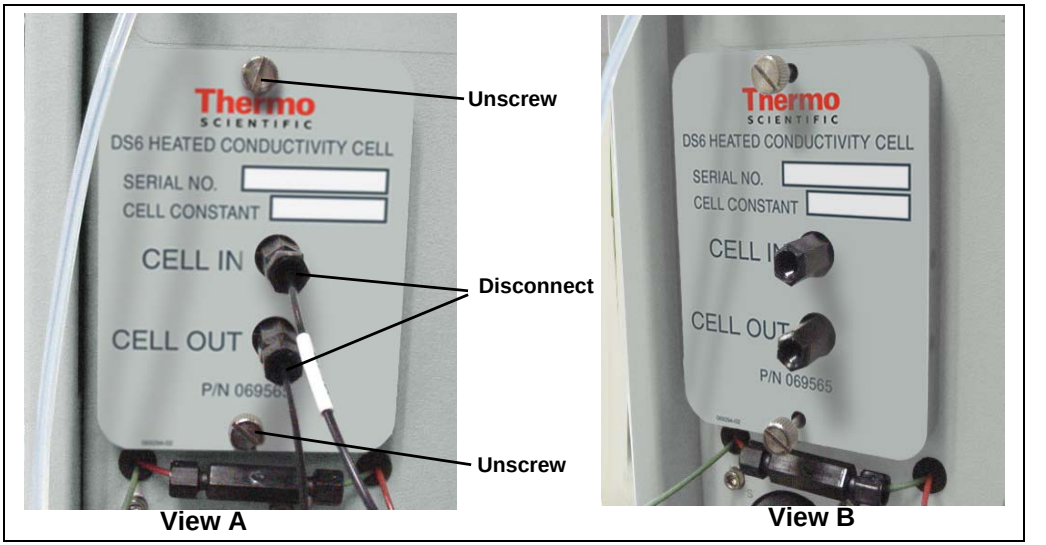


Figure 5-17. Removing the Cell Front Cover

3. Grip the two loosened screws and pull the cell cover toward you to remove it from the component panel. **Do not pull from the CELL IN and CELL OUT fittings.**
4. Continue pulling on the cover until the attached cell assembly slides out the front of the Dionex ICS-1600 (see Figure 5-18).

Figure 5-18. Removing the Cell Assembly

5. Slide the new cell assembly straight into the opening in the component panel until it stops and the cell cover is flush against the component panel. The cell's electronic connector automatically plugs into a connector inside the Dionex ICS-1600 when you push the assembly into the opening.
6. Tighten the screws on the cell front cover fingertight.
7. Close the side panel door and tighten the two mounting screws.
8. Reconnect the inlet and outlet lines.
9. Turn on the Dionex ICS-1600 power.
10. Calibrate the new cell in Chromeleon or on the Dionex ICS-1600 touch screen **DIAGNOSTIC** page. Calibration of a new cell consists of three parts:
    - Running the offset calibration, which measures the output of the cell electronics alone and determines an offset value to be applied to raw conductivity readings.
    - Running the slope calibration, which measures the output of the cell electronics when a built-in dummy cell, which provides a constant conductivity reading of 21 µS, is automatically enabled. The slope value is applied to raw conductivity readings.
    - Entering the cell constant measured at the factory. The Dionex ICS-1600 uses the cell constant to determine the measured conductivity.

    To calibrate the cell in Chromeleon:

    a. Open the Wellness Panel (see Section 5.1.1)

    b. Under **Electric Conductivity Cell Calibration**, click **Offset Cal**.

    c. When the offset calibration is complete, click **Slope Cal**.

    d. Click **Calibration Details**. Under **Conductivity Cell Cal Details**, enter the **Cell Constant** value printed on the front of the cell.

    e. In the field next to the **Download** button, verify that **Current** is selected and then click **Download** to download the new value to the Dionex ICS-1600.

    f. To ensure that the new values are recorded in the Dionex ICS-1600 memory, do not turn off the Dionex ICS-1600 power for at least 1 minute after downloading.

To calibrate the cell on the Dionex ICS-1600 touch screen DIAGNOSTIC page:

a. Go to the **DIAGNOSTIC** page and touch **Electric Conductivity Cell**.

b. On the **ELECTRIC CONDUCTIVITY CALIBRATION** page (see Figure 5-19), touch **Run Offset Cal**.

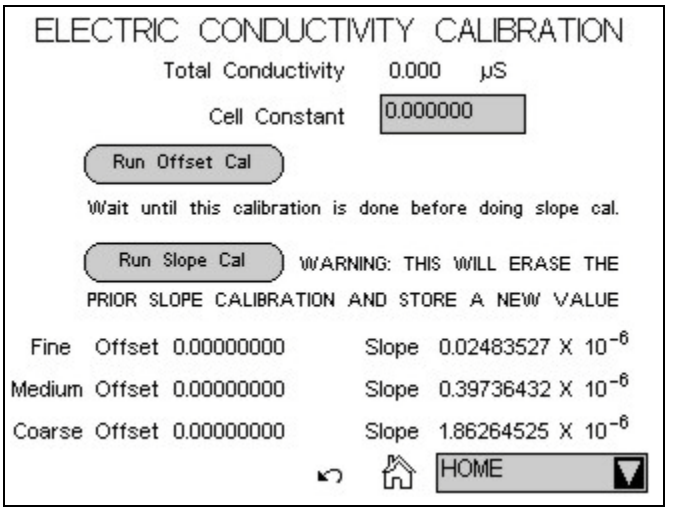

ELECTRIC CONDUCTIVITY CALIBRATION
Total Conductivity 0.000 µS
Cell Constant 0.000000
Run Offset Cal
Wait until this calibration is done before doing slope cal.
Run Slope Cal
WARNING: THIS WILL ERASE THE PRIOR SLOPE CALIBRATION AND STORE A NEW VALUE
Fine Offset 0.00000000 Slope 0.02483527 X 10-6
Medium Offset 0.00000000 Slope 0.39736432 X 10-6
Coarse Offset 0.00000000 Slope 1.86264525 X 10-6
HOME

Figure 5-19. Electric Conductivity Calibration Page

c. When the offset calibration is complete, touch **Run Slope Cal**.

d. Touch the **Cell Constant** field and enter the value printed on the front of the cell.

e. To ensure that the new calibration values are recorded in the Dionex ICS-1600 memory, do not turn off the Dionex ICS-1600 power for at least 1 minute.

f. Record the new calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see Section 5.1.1) and click **Upload** under **Update Wellness Database**.

5.11 Replacing the Suppressor

Refer to the suppressor manual for guidance about when to replace a suppressor. Suppressor manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).

1. Refer to the suppressor quick start guide (shipped with the suppressor) for instructions on preparing the suppressor before initial use and for additional installation details.
2. Turn off the pump from the Dionex ICS-1600 Control panel in Chromeleon or from the touch screen **HOME** page.
3. Open the front door of the Dionex ICS-1600.
4. Disconnect the two eluent and the two regenerant lines from the suppressor.
5. To remove the suppressor from the component panel, slide it up to detach it from the mounting tabs on the panel and then pull it toward you.
6. Continue pulling the suppressor out until the yellow connector on the cable inside the Dionex ICS-1600 is outside the panel (see Figure 5-20).
7. Disconnect the suppressor cable (twist the ring on the yellow connector and pull the two connectors apart).

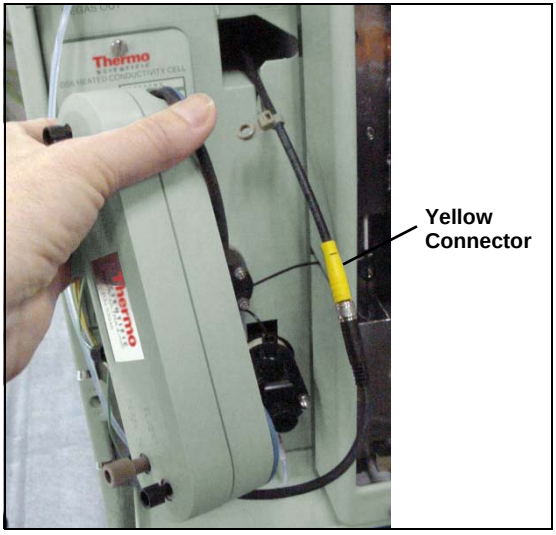
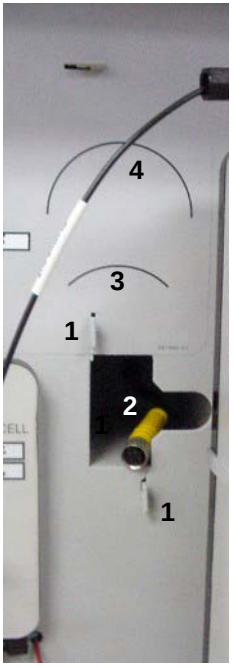


Figure 5-20. Removing the Suppressor

8. Connect the cable from the new suppressor to the Dionex ICS-1600 cable (align the pins on the two connectors and push them together).
9. Orient the suppressor with the **REGEN OUT** fitting on top and the cables to the right.

10. Push the cables into the opening in the component panel.
11. Align the top of the suppressor with the guide line printed on the component panel (see Figure 5-21) and align the slots on the rear of the suppressor with the tabs on the panel.
12. Press the suppressor onto the tabs and then slide it down until it locks into place. Pull slightly on the center of the suppressor to verify that it is securely fastened. **Note**: Some suppressors require more force to secure them onto the tabs.
13. Connect the two eluent and two regenerant lines to the new suppressor.
14. Close the Dionex ICS-1600 front door.



1 Suppressor Mounting Tabs
2 Suppressor Cable Connector
3 Guideline for AES
4 Guideline for SRS

Figure 5-21. Suppressor Guidelines and Mounting Tabs on Component Panel

5.12 Replacing the Column Heater

1. Turn off the Dionex ICS-1600 power.
2. Open the front door of the Dionex ICS-1600.
3. Remove the existing column heater:
   a. Unscrew the two thumbscrews on the heater cover (they remain attached to the cover).
   b. Pull the heater cover straight out to remove it.
   c. Unscrew the six thumbscrews on the top metal plate (see Figure 5-22) and remove the plate.

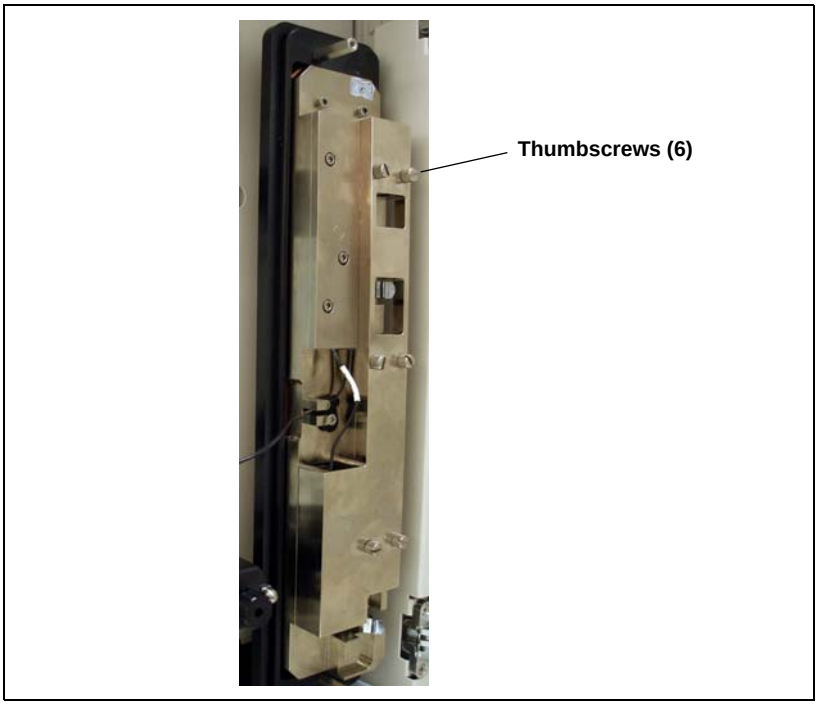


Figure 5-22. Dionex ICS-1600 Column Heater Cover Removed

d. Remove the columns from the column heater.

e. Pull the column heater straight toward you to remove it from the component panel.

4. Before installing the new column heater, write down the two calibration values (offset and slope) recorded on the back of the heater.
5. Align the connector on the back of the new column heater (P/N 069564) with the connector on the component panel and push the column heater onto the component panel.
6. Remove the heater cover and the metal plate on the new heater.
7. Install the columns in the new heater and replace the top metal plate and heater cover.
8. Turn on the Dionex ICS-1600 power.

9. Enter the column heater calibration values in Chromeleon or on the Dionex ICS-1600 touch screen **DIAGNOSTIC** page as follows.

   To enter the calibration values in Chromeleon:

   a. Open the Wellness Panel (see Section 5.1.1) and click **Calibration Details**.

   b. Under **Column Heater Calibration Values**, enter the **Column Heater Offset** and **Column Heater Slope** values recorded in Step 4.

   c. In the field next to the **Download** button, verify that **Current** is selected and then click **Download** to download the new calibration values to the Dionex ICS-1600.

   d. To ensure the new calibration values are recorded in the Dionex ICS-1600 memory, do not turn off the Dionex ICS-1600 power for at least 1 minute after downloading the values.

   To enter the calibration values on the Dionex ICS-1600 touch screen **DIAGNOSTIC** page:

   a. Go to the **DIAGNOSTIC** page and touch **Column Heater Cal Values**.

   b. On the **COLUMN HEATER CAL VALUES** page (see Figure 5-23), enter the **Calibrated Offset** and **Calibrated Slope** values recorded in Step 4.

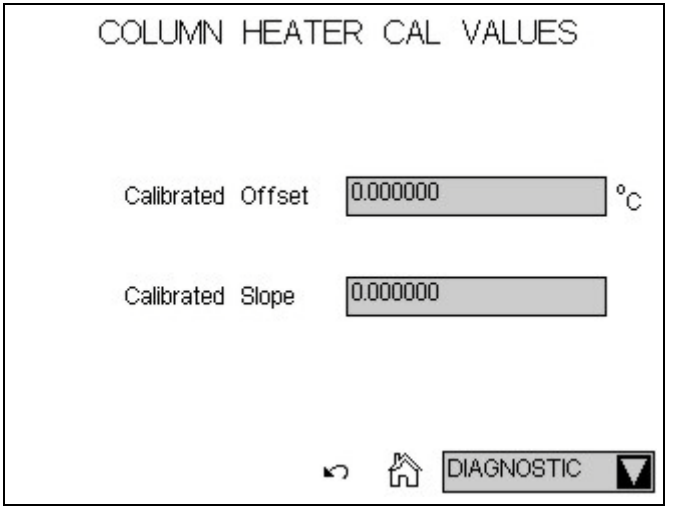


Figure 5-23. Column Heater Cal Values Page

c. To ensure the calibration values are recorded in the Dionex ICS-1600 memory, do not turn off the Dionex ICS-1600 power for at least 1 minute after entering the values.

d. Record the calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see Section 5.1.1) and click **Upload** under **Update Wellness Database**.

5.13 Replacing the Column Heater Heat Exchanger

1. Turn off the Dionex ICS-1600 power.
2. Open the front door of the Dionex ICS-1600.
3. Unscrew the two thumbscrews on the column heater cover (they remain attached to the cover).
4. Pull the heater cover straight out to remove it.
5. Unscrew the six thumbscrews on the top metal plate (see Figure 5-24) and remove the plate.
6. Disconnect the heat exchanger inlet line from port C on the injection valve.

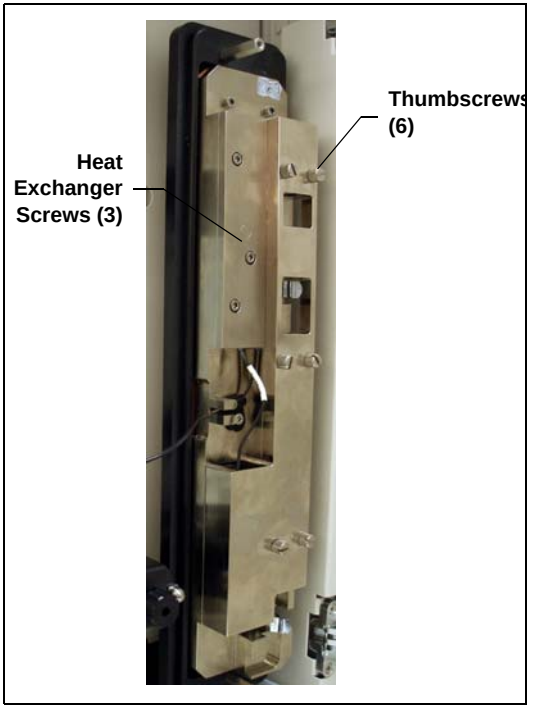


Figure 5-24. Dionex ICS-1600 Column Heater Cover Removed

7. Disconnect the heat exchanger outlet line from the guard column inlet.
8. Use an Allen wrench to remove the three screws from the heat exchanger metal plate and remove the plate (with the tubing) from the heater.

9. Remove the plastic backing from the new heat exchanger (P/N 059979, with 0.25-mm (0.010-in) ID tubing; P/N 060943, with 0.125-mm (0.005-in) ID tubing) and press the heat exchanger onto the heater. Replace the screws removed in Step 8.
10. Connect the new heat exchanger inlet line to port C on the injection valve and connect the outlet line to the guard column inlet.
11. Reinstall the top metal plate and the heater cover.

5.14 Replacing the Eluent Valve

1. Turn off the power to the Dionex ICS-1600.
2. Open the Dionex ICS-1600 front door.
3. To prevent an eluent leak during the valve replacement procedure, disconnect the eluent line from the reservoir cap *or* plug the line on the left side of the valve with a coupler (P/N 039056) and a plug (P/N 037268) after you disconnect the liquid line from the valve in Step 4.
4. Disconnect the two liquid lines connected to the eluent valve (see Figure 5-25).
5. Unscrew and remove the two screws that attach the valve to the component panel (see Figure 5-25). Save the screws.

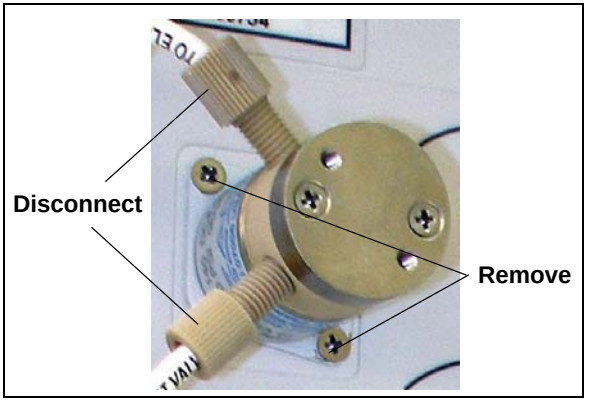


Figure 5-25. Eluent Valve

6. Pull the valve straight out from the component panel and begin pulling the attached cable out of the opening in the panel.
7. The cable is connected to a matching cable inside the Dionex ICS-1600. Continue pulling until the connectors for the two cables are outside the panel (see Figure 5-26). Disconnect the cables.

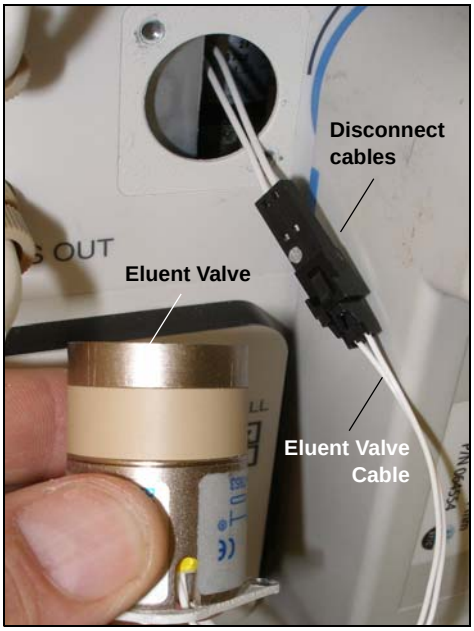


Figure 5-26. Eluent Valve Cable

8. Remove the mounting plate on the old valve by unscrewing and removing the two screws. Save the screws.
9. Thread the cable from the new eluent valve through the mounting plate.
10. Attach the mounting plate to the new valve using the screws removed in Step 8.

Figure 5-27. Removing the Eluent Valve Mounting Plate

11. Connect the cable from the new valve (P/N 057945) to the Dionex ICS-1600 cable. Feed the cables back inside the Dionex ICS-1600.

12. Align the new valve on the component panel with the liquid ports facing up and attach it with the two screws removed in Step 5. Reconnect the liquid lines.
13. Turn on the power to the Dionex ICS-1600.
14. Prime the pump (see Section 5.17).

5.15 Replacing the Leak Sensor

1. Turn off the power to the Dionex ICS-1600.
2. Open the Dionex ICS-1600 front door.
3. Loosen the screw on the front of the leak sensor (see Figure 5-28). **Note:** The screw remains attached to the sensor.

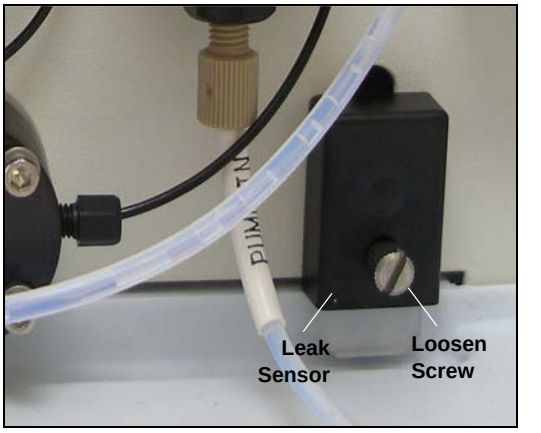


Figure 5-28. Leak Sensor

4. Remove the leak sensor from the component panel and pull the cable out of the opening in the panel.
5. The cable attached to the leak sensor is connected to a matching cable inside the Dionex ICS-1600. Continue pulling the cable until the connectors for the two cables are outside of the panel (see Figure 5-29).
6. Disconnect the two cables.

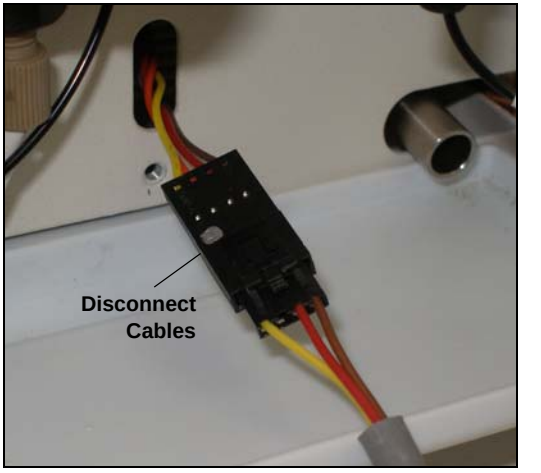


Figure 5-29. Leak Sensor Cable

7. Connect the cable from the new leak sensor (P/N 058053) to the Dionex ICS-1600 cable.
8. Feed the cables back inside the Dionex ICS-1600. Align the leak sensor with the component panel opening and fingertighten the screw.
9. Make sure the leak sensor does not touch the bottom of the drip tray.

5.16 Priming the Pump

1. Verify that the eluent reservoir is filled, the reservoir cap is installed and hand tightened, and the liquid line from the Dionex ICS-1600 to the reservoir cap is connected.
2. Verify that the waste lines are directed to a waste container.
3. The priming procedure consists of two parts:
   - Priming the eluent lines with a syringe (see Section 5.16.1). Perform this procedure at initial installation, after changing eluents, or when eluent lines are empty.
   - Priming the pump heads with the **Prime** button (see Section 5.16.2). Perform this procedure after the eluent lines are primed.

5.16.1 Priming the Eluent Lines with a Syringe

NOTE Prime the eluent lines after initial installation, after changing eluents, or when eluent lines are empty.

1. Verify that the pump is turned off.
2. Connect a 10 mL syringe (P/N 079803) to the priming valve port on the primary pump head (see Figure 5-30).

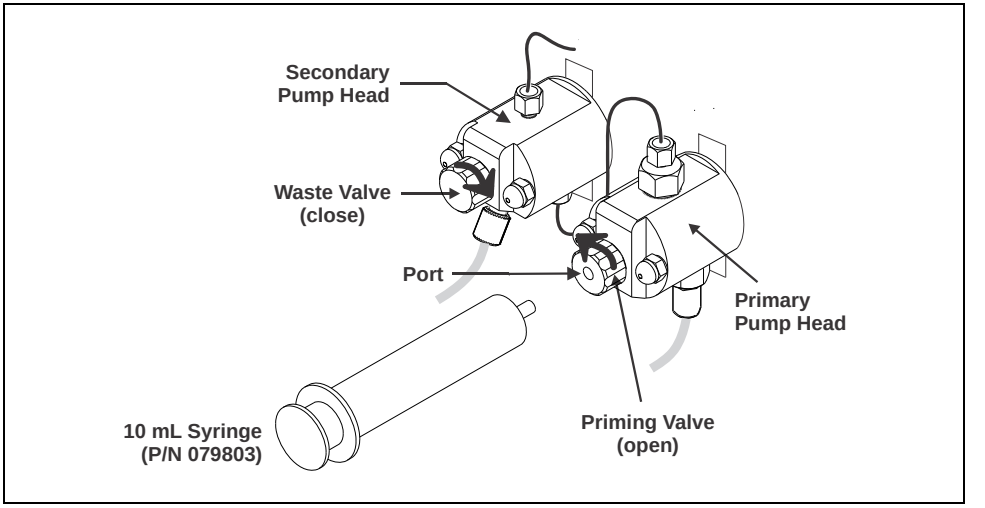


Figure 5-30. Priming the Eluent Lines

3. Open the priming valve by turning it one-quarter to one-half turn counterclockwise.
4. On the Dionex ICS-1600 Control panel in Chromeleon, click the **Pump Settings** button. The **Pump Settings** window opens (see Figure 3-6).
5. Under **Eluent Flow Valve**, click the **Open** button.
6. Draw the syringe back to begin pulling eluent through the flow path. It may take several syringe draws to remove all air or previous eluent from the tubing.

   NOTE If the vacuum degas assembly is installed, draw out an additional 20 mL of eluent.

7. After priming the lines thoroughly, close the priming valve. **Do not overtighten**.

5.16.2 Priming with the Prime Button

NOTE Perform this procedure after priming the eluent lines (see Section 5.16.1).

1. Check that the priming valve on the primary pump head is closed (see Figure 5-31).

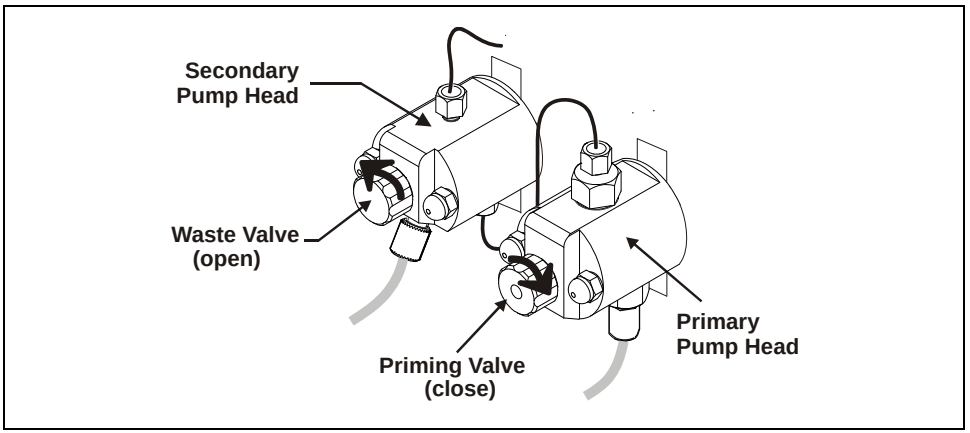


Figure 5-31. Priming the Pump

2. Open the waste valve on the secondary pump head by turning the knob one-quarter to one-half turn counterclockwise (see Figure 5-31). Opening the valve directs the eluent flow path to waste and eliminates backpressure.
3. In the **Pump Settings** window (see Figure 3-6), click the **Prime** button. Confirm that the waste valve is open by clicking **OK** when the reminder message appears. The pump will begin pumping at about 3 mL/min.
4. Continue priming the Dionex ICS-1600 until no air bubbles are exiting the pump waste line.
5. In the **Pump Settings** window, click **Pump Off**.
6. Close the waste valve. **Do not overtighten the valve.**

5.17 Priming the Pump with Isopropyl Alcohol

NOTE Prime the pump heads with isopropyl alcohol only if the two standard priming procedures described in Section 5.16 are unsuccessful.

1. Connect a 10 mL syringe (P/N 079803) filled with isopropyl alcohol (IPA) to the port in the primary pump head (see Figure 5-32).
2. Open the waste valve on the secondary pump head (see Figure 5-32) by turning the knob one-quarter to one-half turn counterclockwise.

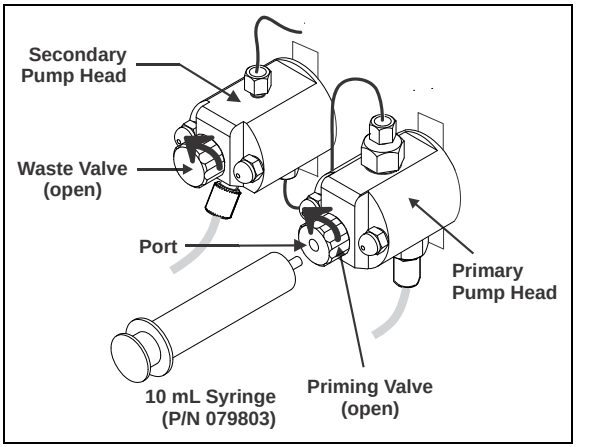


Figure 5-32. Priming the Pump Heads with IPA

3. In the **Pump Settings** window (see Figure 3-6), click **Pump On**.
4. Open the priming valve on the primary pump head by turning it one-quarter to one-half turn counterclockwise.
5. Use the syringe to slowly push alcohol through the pump.

NOTE Be careful not to push any air trapped in the syringe through the pump. Check the waste line from the secondary pump head to verify that there are no air bubbles.

6. Close the priming valve. **Do not overtighten.** Disconnect the syringe from the priming valve.
7. Let the pump run for several minutes, to purge alcohol from the pump heads. Then, click the **Prime** button in the **Pump Settings** window to flush the heads with the desired eluent.

IMPORTANT **Isopropyl alcohol may damage some columns. Be sure to thoroughly rinse the alcohol from the pump, using the process described in Step 7.**

8. Close the waste valve. **Do not overtighten.**
9. Select the flow rate required for the analysis.
10. In the **Pump Settings** window, click **Pump Off**.

5.18 Changing Main Power Fuses

1. Turn off the main power switch.

DANGER **HIGH VOLTAGE—Disconnect the main power cord from its source and also from the rear panel of the Dionex ICS-1600.**

DANGER **HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau arrière du Dionex ICS-1600.**

ACHTUNG **HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf der Rückseite des Dionex ICS-1600.**

2. The fuse holder is part of the main power receptacle (see Figure 5-33) on the Dionex ICS-1600 rear panel. To remove the fuse holder, squeeze the tab on the top of the holder to release it and pull the holder straight out of its compartment.

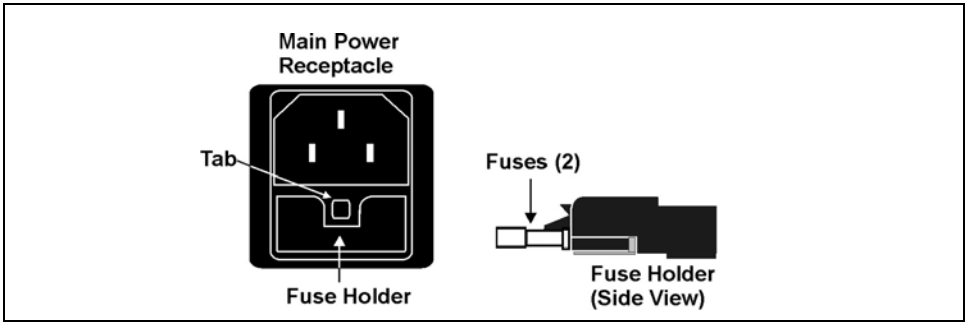


Figure 5-33. Main Power Fuse Holder

3. Replace the two fuses in the holder with new IEC 127 fast-blow fuses rated 3.15 amps (P/N 954745). Thermo Fisher Scientific recommends always replacing both fuses.
4. Reinsert the fuse holder into its compartment and push in until the tab clicks in place.
5. Reconnect the main power cord and turn on the power.

A • Specifications

A.1 Electrical

Main Power	100 to 240 Vac, 50 to 60 Hz (Auto-sensing power supply; no manual voltage or frequency adjustment required)
Fuses	Two 3.15 amp fast-blow IEC 127 fuses (P/N 954745)

A.2 Physical

Dimensions (Without reservoir)	Height: 56.1 cm (22.1 in) Width: 22.4 cm (8.8 in) Depth: 53.3 cm (21.0 in)
Weight	24.5 kg (54 lb)
Decibel Level	<52 dBA
Control Modes	Full control through front panel and Chromeleon software; alternative control through TTL or relay closure (two relay outputs, two TTL outputs, four programmable inputs)
USB Communication Protocol	One USB input; one built-in USB hub with two outputs

A.3 Environmental

Operating Temperature	4 to 40 °C (40 to 104 °F); cold room-compatible (4 °C) as long as system power remains on
Operating Humidity	5% to 95% relative humidity, noncondensing
Operating Pressure	35 MPa (5000 psi) maximum liquid path (tubing, valve, columns, etc.)

A.4 Front Panel

Power LED	On when power is present; off when no power is present
LCD Touch Screen	¼ VGA (320 x 240 pixels) liquid crystal display with touch screen, which provides: • Local control of Dionex ICS-1600 components: pump, detector, suppressor, injection valve, column heater, vacuum degas, TTLs, and relays • Display of conductivity data plot and operating status • Local control of calibration and diagnostic functions

A.5 Analytical Pump and Fluidics

Type	Serial dual-reciprocating pistons, microprocessor-controlled constant stroke, variable speed
Construction	Chemically inert, metal-free PEEK pump heads and flow paths compatible with aqueous eluents of pH 0 to 14 and reversed-phase solvents
Operating Pressure	0 to 35 MPa (0 to 5000 psi)
Flow Rate Range	0.00 to 5.00 mL/min in 0.01 mL/min increments without changing pump heads
Flow Precision	<0.1% typical

Flow Accuracy	<0.1% typical
Pressure Ripple	<1% at 13.8 MPa (2000 psi) and 1.0 mL/min
Eluent On/Off Valve	Standard feature
Piston Seal Wash	Dual-pump head; wash can be continuous when connected to rinse solution supply
Pressure Alarm Limits	• **Upper limit:** 0 to 35 MPa or 0 to 5000 psi in one unit (MPa or psi) increments • **Lower limit:** Up to one unit lower than upper limit
Vacuum Degas	Optional feature; automatic control
Eluent Bottles	Polypropylene
Eluent Bottle Pressure	Not required
Leak Detection	Built-in optical sensor

A.6 Eluent Regeneration

Eluent Regeneration	Optional feature; RFIC-ER Startup Kit required
Eluents	• Carbonate and carbonate/bicarbonate up to 20 mM • MSA up to 34 mM
Flow Rates	0.01 to 2.00 mL/min
Continuous Operation (4 L of Eluent)	Up to 28 days or 2000 samples, typically
Always On/ Always Ready Capable	Standard feature
Remains Fully Calibrated for Extended Periods (≤28 days)	Standard feature; results are traceable to a single calibration
System Wellness	Consumables usage monitoring for predictive maintenance
Maximum Operating Pressure	21 MPa (3000 psi)
Operating Temperature Range	4 to 40 °C (40 to 104 °F)

A.7 Detector Electronics

Type	Microprocessor-controlled digital signal processor
Cell Drive	8 kHz square wave
Detector Linearity	1% up to 1 mS
Resolution	0.00238 nS/cm

Full-Scale Output Ranges	• **Digital signal range:** 0 to 15,000 µS • **Analog signal range:** 0 to 15,000 µS
Electronic Noise	±0.1 nS/cm when background conductivity is 0 to 150 µS/cm ±2 nS/cm when background conductivity is 151 to 3200 µS/cm
Filter	Rise times from 0 to 10 s; user-selectable
Temperature Compensation	Fixed at 1.7% per 1 °C at cell temperature
Temperature Range	Ambient +7 °C; 30 to 55 °C
Temperature Stability	<0.01 °C

A.8 Conductivity Cell with Heat Exchanger

Cell Body	Chemically inert polymeric material
Cell Electrodes	Passivated 316 stainless steel; compatible with MSA
Cell Volume	<1 µL
Maximum Cell Operating Pressure	10 MPa (1500 psi)
Heat Exchanger	Inert, tortuous path for low axial dispersion
Operating Temperature	30 to 55 ºC (86 to 130 ºF); must be at least 7 ºC above the ambient temperature

A.9 Injection Valve

Injection Valve	6-port, 2-position Rheodyne valve with PEEK wetted components; electrically-activated

A.10 Auxiliary Valve (Optional)

Auxiliary Valve	6-port or 10-port, 2-position Rheodyne valve with PEEK wetted components; electrically-activated

A.11 Vacuum Degas Assembly (Optional)

Channel	Single-channel degas channel with degas membranes
Pump	Dual-stage diaphragm vacuum pump
Materials	Wetted materials, PEEK, PTFE

A.12 Column Heater

Operating Temperature	30 to 60 °C (86 to 140 °F); minimum 5 °C above ambient temperature. Settable range is equal to working range.
Temperature Stability	±0.5 °C at sensor
Temperature Accuracy	±0.5 °C at sensor, at 40 °C
Maximum Column Lengths	250 mm analytical column with 50 mm guard column

A.13 Suppressors

Chemical Suppression	2 mm and 4 mm anion and cation, membrane suppression bed types
Displacement Chemical Regeneration	2 mm and 4 mm anion and cation, membrane suppression bed types
Electrolytic Suppression	• **Self-Regenerating:** 2 mm and 4 mm anion and cation; both membrane and MonoDisk™ suppression bed types available • **Self-Regenerating with External Water Mode:** 2 mm and 4 mm anion and cation; both membrane and MonoDisk suppression bed types available
Current Control Range	SRS (4 mm): 0 to 300 mA in 1 mA increments SRS (2 mm): 0 to 100 mA in 1 mA increments AES: 0 to 150 mA in 1 mA increments CMD: 0 to 500 mA in 1 mA increments SRN: 0 to 500 mA in 1 mA increments
Salt Converter	2 mm and 4 mm versions available
Dionex AMMS ICE™	2 mm and 4 mm versions available
Carbonic Acid Removal for Anions	ASRS™ 300 with CRD 200 for hydroxide eluents ASRS 300 with CRD 300 for carbonate eluents
Non-Suppressed	Supported
Suppressor Wear Parts	None; peristaltic pump and inline filters not required
Suppression Capacity	Anion SRS 300 (4 mm): 200 µeq/min Cation SRS 300 (4 mm): 110 µeq/min Anion SRS 300 (2 mm): 50 µeq/min Cation SRS 300 (2 mm): 37.5 µeq/min Anion MMS 300 (4 mm): 150 µeq/min Cation MMS 300 (4 mm): 150 µeq/min Anion MMS 300 (2 mm): 37.5 µeq/min Cation MMS 300 (2 mm): 37.5 µeq/min Anion AES: 25 µeq/min Cation AES: 25 µeq/min

Void Volume	SRS 300 (4 mm): <50 µL SRS 300 (2 mm): <15 µL MMS 300 (4 mm): <50 µL MMS 300 (2 mm): <15 µL AMMS ICE 300 (4 mm): <50 µL AMMS ICE 300 (2 mm): <15 µL Anion AES: <35 µL Cation AES: <35 µL

A.14 Autosampler

Automation Using Autosampler	Dionex AS, Dionex AS-AP, Dionex AS-DV, or Dionex AS-HV Autosampler (or third-party autosampler)
Sequential/ Simultaneous Injection	May be available; depends on autosampler capabilities
Automated Dilution	Available with a Dionex AS Autosampler • **Dilution Factor:** 1:1 to 1:1000 • **Dilution Time:** 15 seconds with sample overlap
Online Sample Degassing	Optional; CRD 200/300 required
Online Filtration	Available with a Dionex AS-DV Autosampler or an inline filter
Automation Flexibility	High, using Chromeleon software and post-run features

A.15 System Software

Software	Chromeleon Chromatography Management System or Chromeleon Xpress; validated for use with Windows Vista or Windows XP
Automated Procedure Wizards	Standard feature
System Wellness and Predictive Performance	Standard feature

Data Trending Plots	Numerical device parameters can be plotted
Virtual Column Simulator	• **Evaluation mode**: Standard feature • **Isocratic and gradient modes**: Optional features
Application Templates	Standard feature
Automation Support for Third-Party Vendors	Fully controls over 300 different instruments from more than 30 manufacturers, including GC, HPLC, and MS
3D Software for PDA, MS, and ED	Optional feature
Customizable System Control Panels	Standard feature
System Status Virtual Channels	Standard feature
Power Failure Protection	Standard feature
Sequential Injection	Standard feature
System Trigger Commands and Conditionals	Standard feature
Daily Audit Trail	Standard feature
Sample Audit Trail	Standard feature
Multiple Network Control and Network Failure Protection	Optional feature
Storage of System Calibration Settings	Factory, current, and previous calibration values are stored; the user can reset current values to factory or previous values

Customized Reporting	Standard feature; unlimited report workbooks
Automated System Qualification	Detailed, comprehensive qualification reports

The LCD touch screen on the Dionex ICS-1600 front panel allows local control of most Dionex ICS-1600 functions. This chapter describes how to operate the Dionex ICS-1600 from the touch screen.

When the Dionex ICS-1600 starts up, the touch screen displays a startup page. This is followed by the **INFORMATION** page, which displays version and serial numbers and a list of installed options. After a few seconds, the **HOME** page (see Figure B-1) is displayed. The **HOME** page provides controls for all normal, daily operation of the Dionex ICS-1600.

B.1 Using the Touch Screen

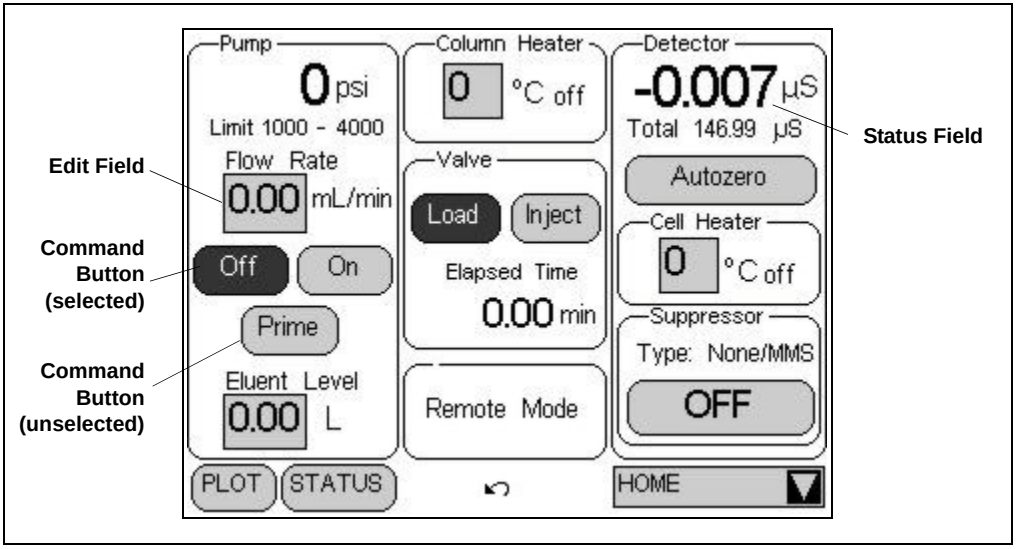


Figure B-1. Dionex ICS-1600 Touch Screen Home Page

NOTE **To adjust the screen contrast, open the front door and adjust the knurled knob under the screen (see Figure 2-8).**

- Edit fields and command buttons have blue text on a lightly shaded background. Fields that display status information are not shaded.
- Edit fields have square corners while command buttons are rounded.
- To edit a field or select a command button, touch and release the field or button with your fingertip.

NOTE **When you touch a button or edit field, the action takes effect when you lift your finger. If you unintentionally touch a button or field, you can cancel the action by sliding your finger away from the button or field before lifting.**

- Touching a command button (for example, Inject) executes the command immediately.
- Selecting a command button changes the button's appearance to white text on a dark background (for example, Inject).
- Touching an edit field (for example, Flow Rate 0.00 mL/min) opens a page with a number keypad (see Figure B-2). Use the keypad to enter the desired numerical value for the field and then touch the **ENTER** button.

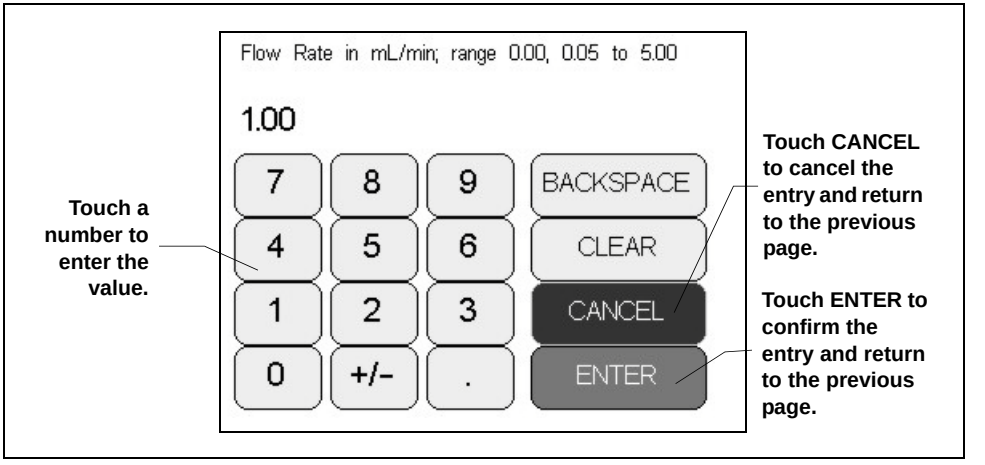


Figure B-2. Number Keypad

- Touching the page name (for example,

) in the bottom right corner opens a menu of pages (see Figure B-3).

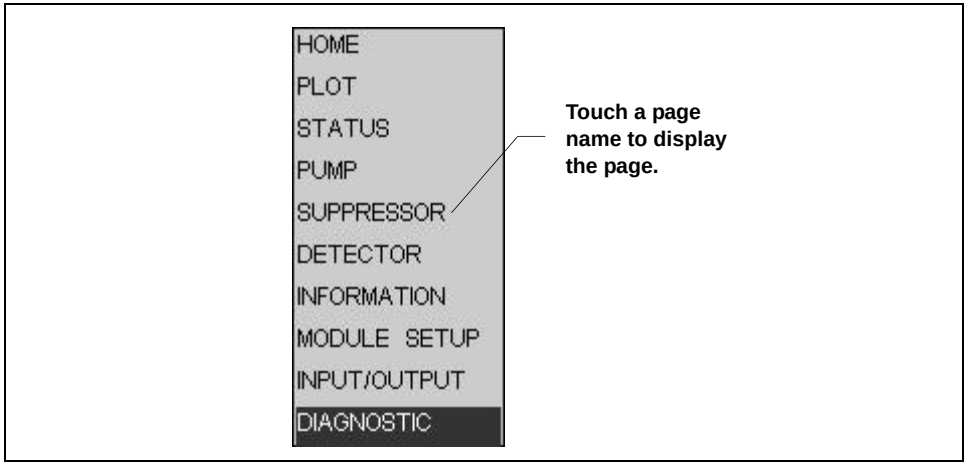


Figure B-3. Dionex ICS-1600 Touch Screen Menu of Pages

- Touching a page name on the menu of pages displays the selected page. For example, touching **SUPPRESSOR** displays the **SUPPRESSOR** page (see Figure B-4).

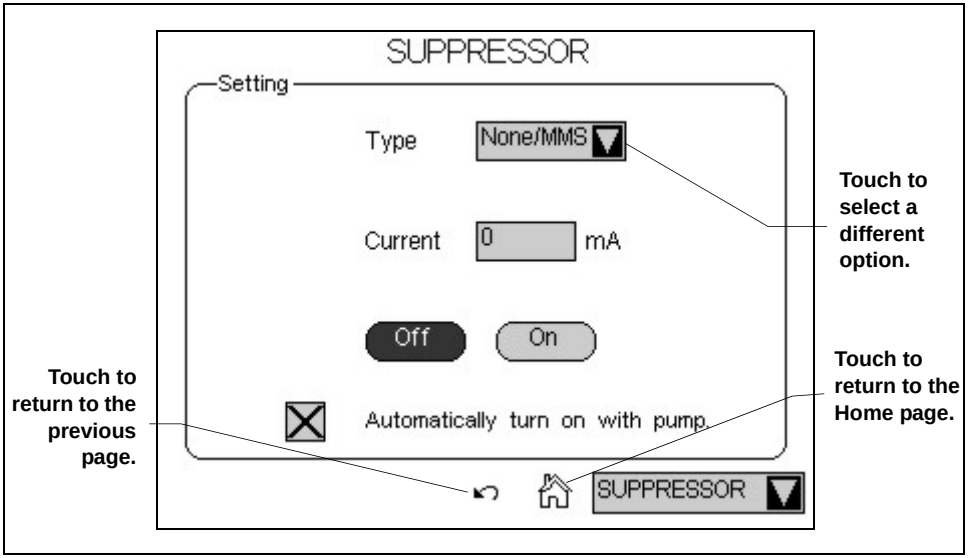


Figure B-4. Suppressor Page

- Touching returns you to the **HOME** page.
- Touching opens a list of options (see Figure B-5).

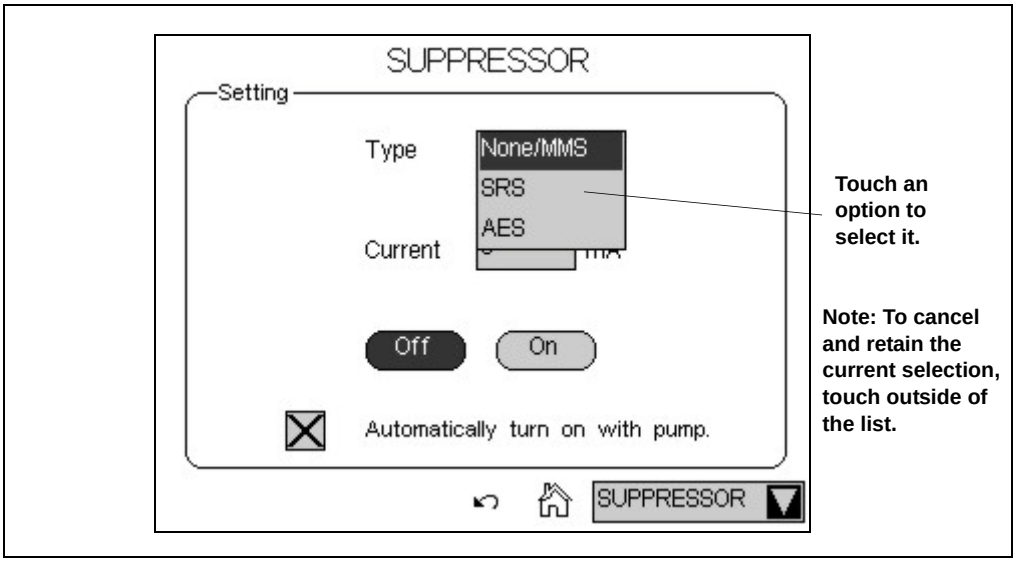
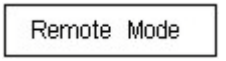


Figure B-5. Suppressor Page: Selecting an Option

B.2 Using the Touch Screen with Chromeleon



When the Dionex ICS-1600 is connected to a Chromeleon Control panel, the status field at the bottom center of the **HOME** page displays **Remote Mode**. In this mode, most of the controls on the touch screen pages are disabled. This prevents touch screen commands from conflicting with Chromeleon commands.

In general, when the Dionex ICS-1600 is connected to Chromeleon, you can:

- View all Dionex ICS-1600 operational status information (pressure, flow rate, conductivity readings, etc.)
- Go to any of the touch screen pages
- View a plot of the conductivity data from the **PLOT** page and adjust the plot display using the controls on the page. See Section B.5 for details.

To restore touch screen (local) control, clear the **Connected** check box on the Chromeleon Control panel.

B.3 Overview of Dionex ICS-1600 Touch Screen Pages

Figure B-6 illustrates the organization of the Dionex ICS-1600 touch screen pages.

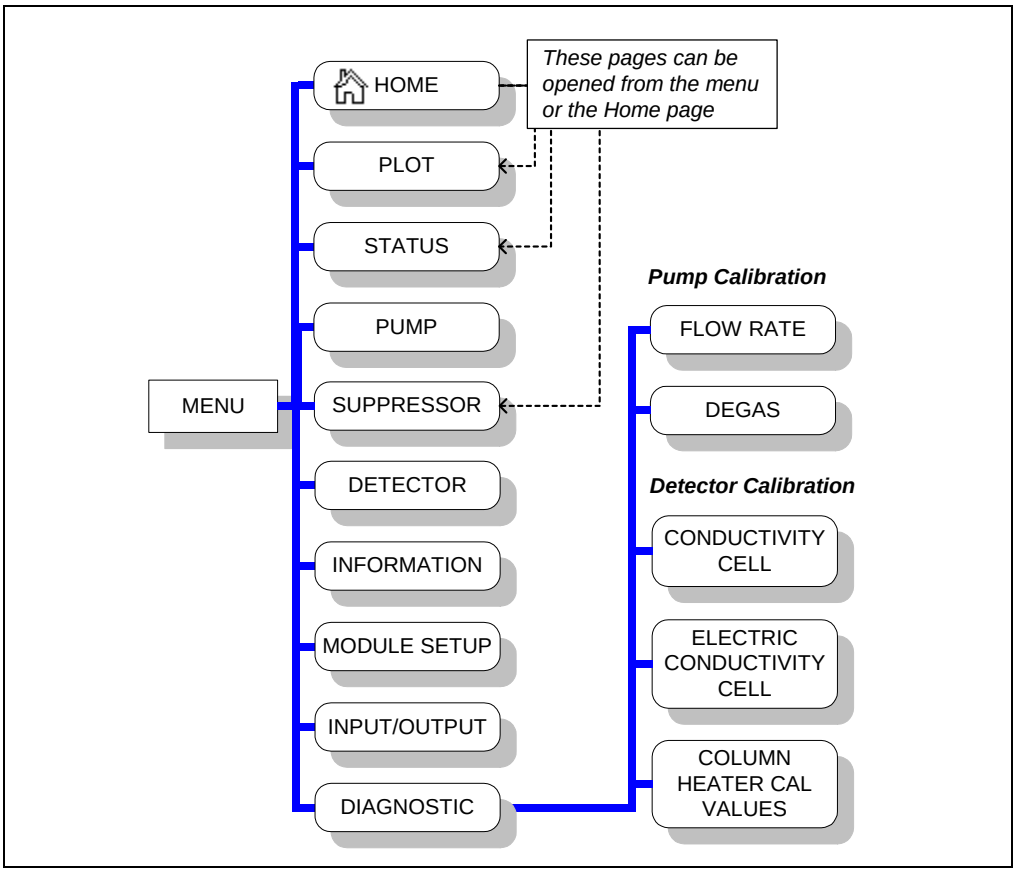


Figure B-6. Overview of Dionex ICS-1600 Touch Screen Pages

B.4 Home Page

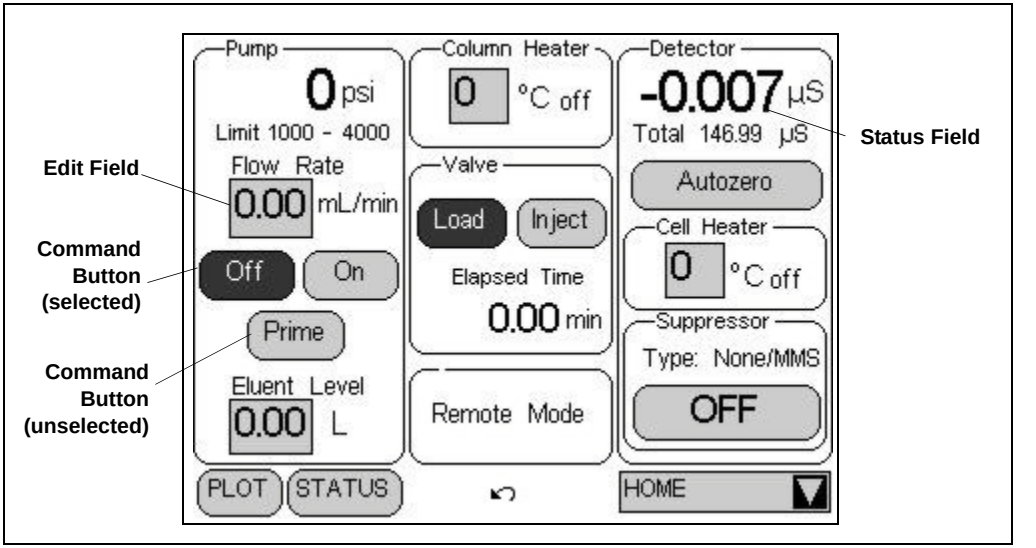
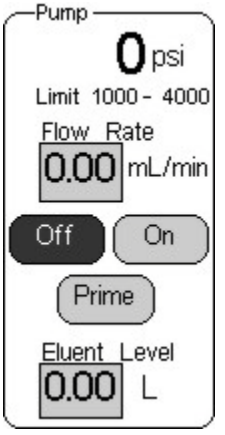


Figure B-7. Dionex ICS-1600 Touch Screen Home Page

B.4.1 Home Page Pump Controls



Pressure Display

The **HOME** page indicates the current pressure reading from the pressure transducer. The pressure unit can be set to psi (the factory default), MPa, or bar (see Section B.7.1).

The minimum and maximum pressure limits are displayed below the current pressure reading. If the pressure reading goes outside these limits, the pump is stopped and an error message appears in the Chromeleon Audit Trail and on the touch screen. See Section 4.2 for troubleshooting information. See Section B.7.1 for how to set the pressure limits.

Flow Rate

The flow rate can be set to 0.00 (which turns off the pump) and to between 0.05 and 5.00 mL/min. The recommended operating flow rate is between 0.40 and 2.00 mL/min. Refer to the column manual for the flow rate to use with your column and application. Column manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).

Pump On/Off Control

Touching the **On** button immediately starts the pump flow at the rate displayed in the **Flow Rate** field. Touching **Off** stops the flow.

Prime

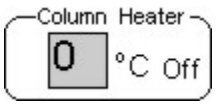
The **Prime** button is reserved for use during the pump head priming procedure. Touching the **Prime** button displays a confirmation page that reminds you to open the waste valve. Open the valve, and then touch the **OK** button to begin priming. Or, to exit the page without priming, touch the **Cancel** button. To stop priming, touch the **Off** button. During priming, the flow rate is approximately 3 mL/min. See Section B.13 for detailed priming instructions.

Eluent Level

Use this field to monitor the amount of liquid in the eluent reservoir. When you fill the reservoir, enter the amount of liquid in the reservoir. For example, if the reservoir contains 200 mL and you add 1 liter, enter 1.2 liters. Thereafter, the Dionex ICS-1600 determines the eluent usage by monitoring the flow rate and the length of time the pump is on. The Dionex ICS-1600 updates the **Eluent Level** field as the eluent is depleted. A warning first appears if the level falls below 200 mL. Warnings are repeated at 100 mL and 0 mL.

IMPORTANT **In order for the eluent level displayed on the screen to be accurate, the level must be entered by the user when the reservoir is filled. The Dionex ICS-1600 does not automatically detect when the reservoir is filled, nor when it is empty.**

B.4.2 Home Page Column Heater

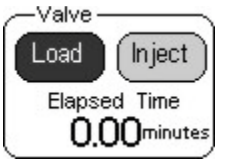


The temperature of the column heater can be controlled to between 30 and 60 °C. For optimal performance, set the column heater to at least 5 °C above the ambient temperature. To set the temperature, touch the **Column Heater** field and enter the desired temperature on the number pad. To turn the

column heater off, set the temperature to 0. The display to the right of the temperature setting indicates the heater status:

=	column temperature is at equilibrium
↑	column temperature is rising
↓	column temperature is falling
Off	column heater is off

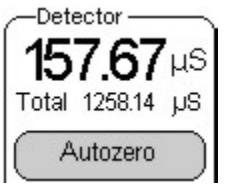
B.4.3 Home Page Injection Valve Controls



The **Inject** and **Load** buttons select the position of the injection valve. A dark background and white text on a button indicates the current valve position. For details about the valve positions, see Section 2.4.4.

The **ELAPSED TIME** field displays the amount of time since the last injection.

B.4.4 Home Page Detector Controls



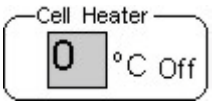
Conductivity Readings

The offset conductivity is displayed in large numbers above the total conductivity. The offset conductivity is the total conductivity minus the current offset.

To determine the offset, allow the system to equilibrate after startup. At equilibration, the conductivity reading is the background conductivity (the eluent conductivity before sample injection). Touch **Autozero** to zero the conductivity and offset this background reading from the total reading.

NOTE **You can reverse the conductivity display to show the total conductivity in large type, with the offset conductivity below it in small type. Select this option on the MODULE SETUP page (see Section B.11).**

Cell Heater Controls

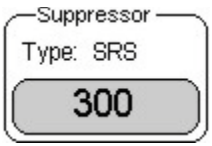


The temperature of the cell can be set to between 30 °C and 55 °C, but must be at least 7 °C above the ambient temperature. To set the temperature, touch the **Cell Heater** field and enter the desired temperature on the number pad.

To turn off the cell heater, set the temperature to 0. The display to the right of the temperature setting indicates the heater status:

=	cell temperature is at equilibrium
↑	cell temperature is rising
↓	cell temperature is falling
Off	cell heater is off

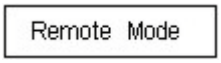
Suppressor Controls



The **Suppressor** controls indicate the suppressor current setting and the type of suppressor installed.

To set the suppressor type, change the current setting, or turn the suppressor on or off, touch the suppressor button. The **SUPPRESSOR** page appears (see Section B.8).

B.4.5 Other Home Page Controls



This field displays **Remote Mode** when the Dionex ICS-1600 is connected to Chromeleon and **Local Mode** when the system is not connected to Chromeleon.

Opens the **PLOT** page, which provides a real-time plot of the detector conductivity output. See Section B.5 for details.

Opens the **STATUS** page, which displays the status of various operating parameters. See Section B.6 for details.

B.5 Plot Page

The **PLOT** page provides a real-time plot of the detector conductivity output. To open the page, touch the **PLOT** button on the **HOME** page, or select **PLOT** from the menu of pages. The page can display up to 60 minutes of data. Data older than 60 minutes is discarded. You can view the plot and adjust the display when the Dionex ICS-1600 is under either local or computer control.

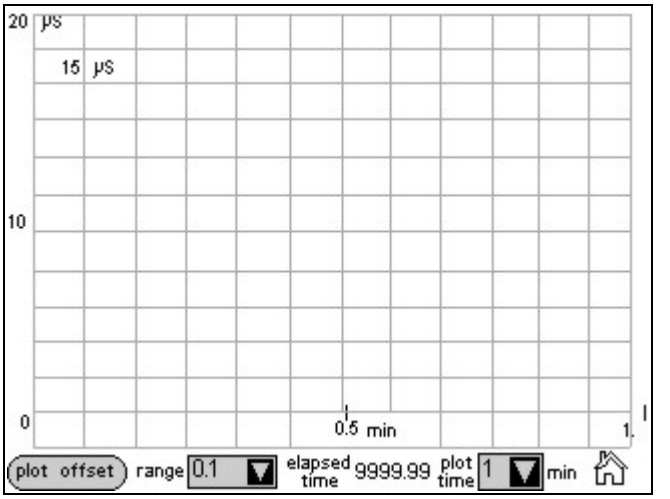


Figure B-8. Plot Page

Plot Controls

- The **plot offset** button offsets the current background conductivity reading and sets the plot baseline to zero. Subsequent output is plotted in relation to the new zero point. Offsetting the plot does not affect the data sent to Chromeleon, the analog output, or the data displayed on other pages.
- The **range** field sets the highest conductivity reading displayed on the plot (the vertical scale). If the tops of peaks are cut off, select a higher range. If peaks are short, select a lower range. Select **Auto** to have the scaling of the signal plot automatically adjusted to the height of the signal.
- The **elapsed time** field displays the time since injection.
- The **plot time** field sets the length of time plotted on the page (the horizontal scale).

B.6 Status Page

The **STATUS** page displays the current status of various operating parameters. To open this page, touch the **STATUS** button on the **HOME** page or select **STATUS** from the menu of pages.

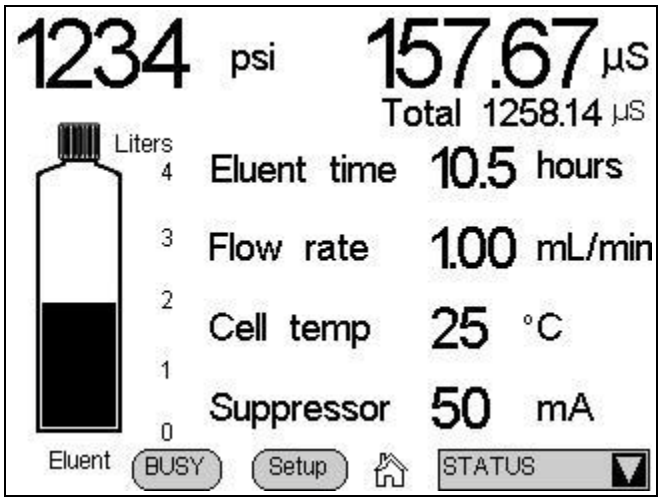


Figure B-9. Status Page

Status Page Controls

- Pressure and conductivity readings are the same as those displayed on the **HOME** page.
- The eluent bottle depicts the level of liquid in the eluent reservoir. The scale is always 0 to 4 liters (regardless of the size of reservoir installed). After filling the reservoir, go to the **HOME** page and enter the amount of liquid in the reservoir (see Section B.4.1). The Dionex ICS-1600 monitors the eluent usage, based on the flow rate and the length of time the pump is on. The "liquid" level in the bottle falls as the reservoir empties. An error message is first displayed on the screen when the level falls below 200 mL. The message is repeated at 100 mL and then at 0 mL.

IMPORTANT **In order for the eluent level displayed on the screen to be accurate, the level must be entered by the user when the reservoir is filled. The Dionex ICS-1600 does not automatically detect when the reservoir is filled, nor when it is empty.**

- The fields to the right of the bottle display the status of four other operating parameters. You can choose from six possible parameters to display here. Figure B-9 shows the default parameters: **Eluent time**, **Flow rate**, **Cell temp**, and **Suppressor**. To select different parameters, touch the **Setup** button. See Section B.6.1 for details about how to change the status parameters, and Section B.6.2 for a description of each parameter.
- Touching the **Busy** button displays the **BUSY** page (see Figure B-10).

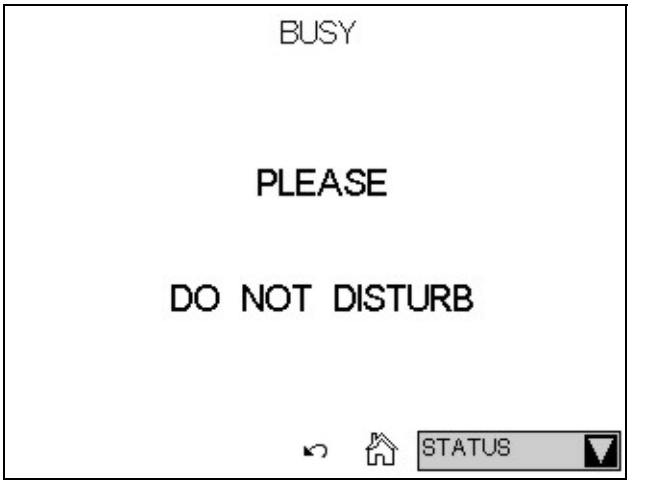


Figure B-10. Busy Page

B.6.1 Viewing Other Status Parameters

Follow the steps below to view the status of a parameter that is not currently displayed on the **STATUS** page.

1. Touch the **Setup** button. A drop-down list replaces the label for each field, and the **Setup** button changes to **Apply** (see Figure B-11).

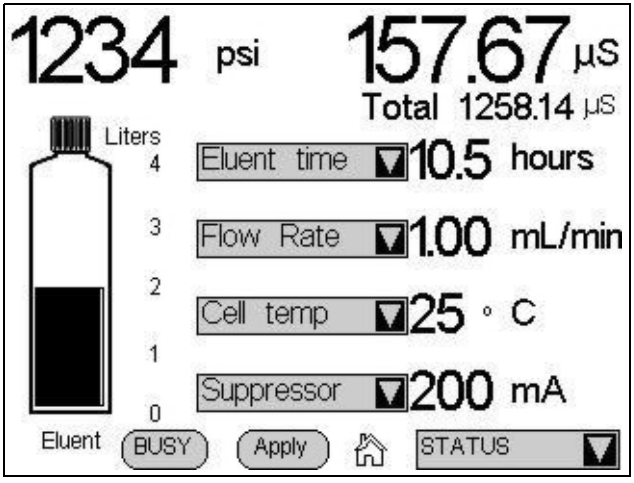


Figure B-11. Status Page Setup

2. Touch the down arrow next to the field you want to change. A list of the available status parameters appears (see Figure B-12).

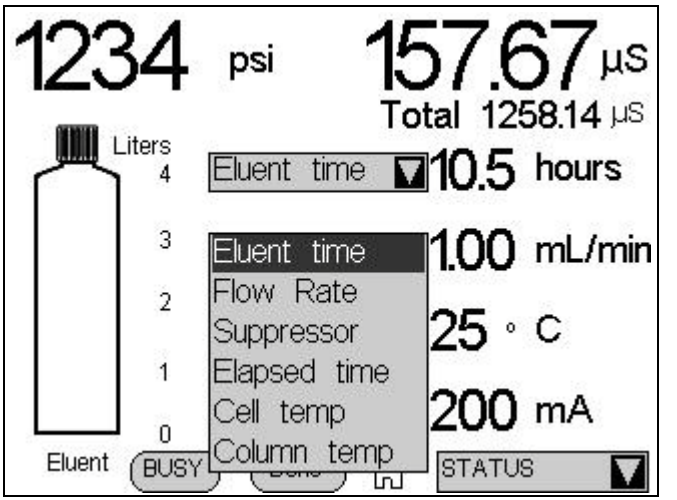


Figure B-12. Status Page Parameter List

3. Touch the parameter you want to display.
4. When finished, touch the **Apply** button.

B.6.2 Status Parameter Details

Status Parameter	Description
Eluent time	The number of hours the eluent supply will last, if the pump runs continuously at the current flow rate.
Flow rate	The actual flow rate currently output by the pump.
Suppressor	The actual current applied to the suppressor.
Elapsed time	The number of hours since the last injection.
Cell temp	The temperature of the cell heater (°C), followed by a status symbol (=, ↑, or ↓).
Column temp	The temperature of the column heater (°C), followed by a status symbol (=, ↑, or ↓).

B.7 Pump Page

Use the **PUMP** page to set parameters related to pump operation, including pressure limits, pressure unit, vacuum degas pump settings, and eluent valve control. To open this page, select **PUMP** from the menu of pages. The current system pressure is displayed at the top of the screen.

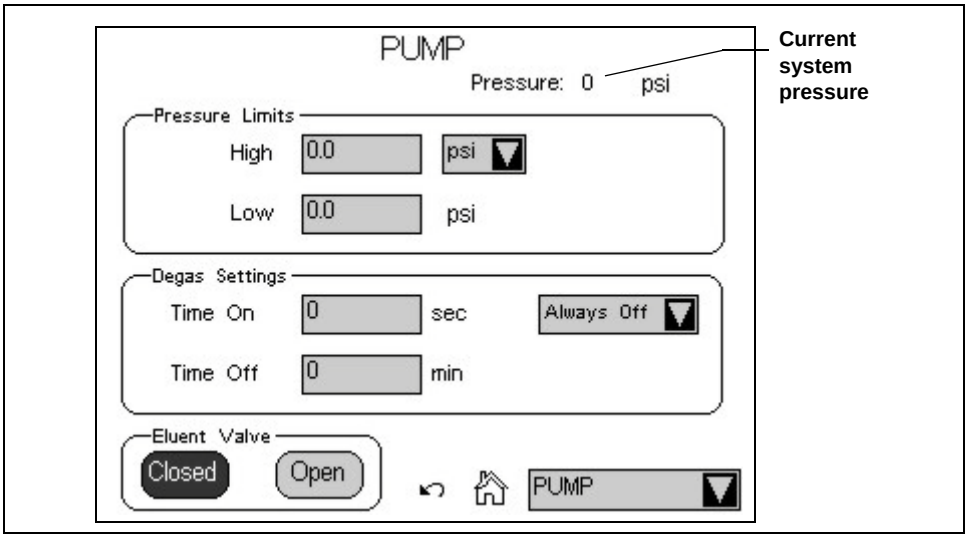


Figure B-13. Dionex ICS-1600 Touch Screen Pump Page

B.7.1 Setting Pump Pressure Limits and Selecting the Pressure Unit

The first time the power to the Dionex ICS-1600 is turned on, the maximum system pressure limit is 34.5 MPa (5000 psi) and the minimum pressure limit is 0.

NOTE Pump pressure limits can also be changed in Chromeleon (in the Server Configuration program or in the control program).

- To change the high pressure limit, touch the **HIGH** field and enter the desired limit on the number pad. The high limit must be at least 0.7 MPa (100 psi) above the low limit.

- To change the low pressure limit, touch the **LOW** field and enter the desired limit on the number pad.

To select the pressure unit for all touch screen pages that display pressure values, touch the pressure unit field and select the desired unit on the list (**PSI**, **bar**, or **MPa**) (see Figure B-14).

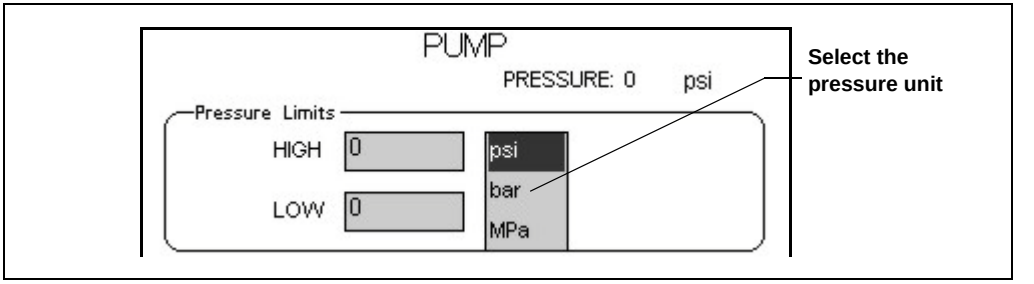


Figure B-14. Pump Page: Selecting the Pressure Unit

B.7.2 Setting Degas Operating Parameters (Optional)

By default, the Dionex ICS-1600 monitors the degas pressure reading and turns the degas pump on and off as required. To change the degas operating option:

1. Select **PUMP** from the menu of pages.
2. Under **Degas Settings**, touch the options drop-down list. A list of available options appears (see Figure B-15).

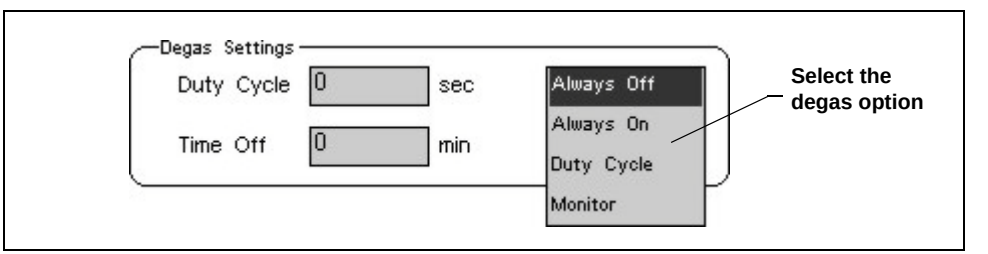


Figure B-15. Pump Page: Selecting Degas Options

NOTE Degas options can also be selected from the Chromeleon Server Configuration program (see Section 2.4.1).

3. Select the desired option:

   Always Off: The degas pump is always off.

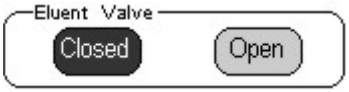
   Always On: The degas pump is always on. This setting is reserved for test purposes by a Thermo Fisher Scientific Service Representative.

IMPORTANT **Select the Degas, Always On option only when testing the vacuum degas assembly. Do not select the Always On option for routine use.**

   Duty Cycle: The degas pump cycles on and off according to the times specified in the **Duty Cycle** and **Time Off** fields. **Duty Cycle** specifies for how long the degas pump runs during a cycle; **Time Off** specifies the time between cycles.

   Monitor: The Dionex ICS-1600 monitors the degas pressure reading and turns the degas pump on and off as required.

B.7.3 Controlling the Eluent Valve



The eluent valve controls flow from the eluent reservoir. During routine operation, the valve opens and closes automatically when the pump flow is turned on and off. However, during eluent line priming, you can use the controls on the **PUMP** page to manually open the valve, allowing liquid to flow through the lines when the pump is off. See **Section B.13.2** for eluent line priming instructions.

B.8 Suppressor Page

Use the **SUPPRESSOR** page to specify the type of suppressor installed in the Dionex ICS-1600, turn the suppressor on and off, and select the amount of current supplied to the suppressor. To open this page, touch the suppressor button on the **HOME** page, or select **SUPPRESSOR** from the menu of pages.

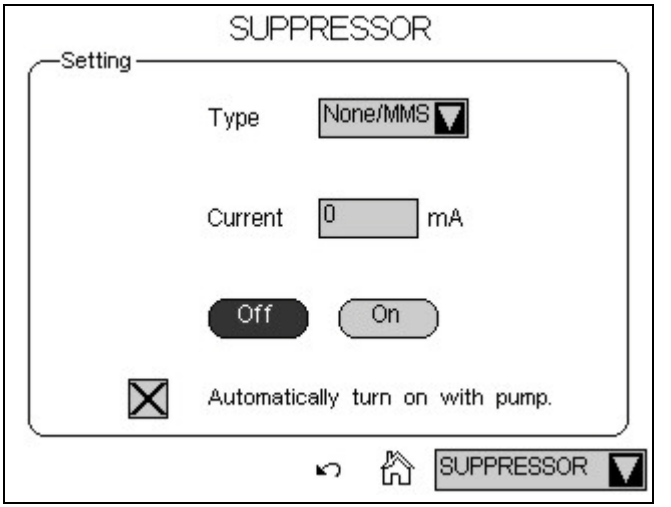


Figure B-16. Suppressor Page

Suppressor Controls

- The suppressor type is typically selected at initial installation and does not need to be changed. However, if a different type of suppressor is installed later (or if the suppressor is removed from the system), touch the **Type** field and select the new suppressor type (**None/MMS**, **SRS**, or **AES**) from the list.
- To set the current, touch the **Current** field and enter the desired setting (in milliamperes) on the number pad.

  The appropriate suppressor current setting depends on several variables: the suppressor type, the column, the eluent, and the flow rate. Refer to the suppressor manual for the recommended current setting for your application. The suppressor manuals are included on the Thermo Scientific Reference Library DVD (P/N 053891).

NOTE When Chromeleon is used to control the Dionex ICS-1600, the Program Wizard automatically calculates the current required for the application.

- To manually control the suppressor power, touch the **Off** and **On** buttons.
- To automatically control the suppressor power simultaneously with the pump flow, select **Automatically turn on with pump**.

NOTE The suppressor always turns off when the pump is off, regardless of whether the "Automatically turn on with pump" option is selected.

B.9 Detector Page

Use the **DETECTOR** page to set the data rise time and to select parameters for adjusting the analog output. To open this page, select **DETECTOR** from the menu of pages.

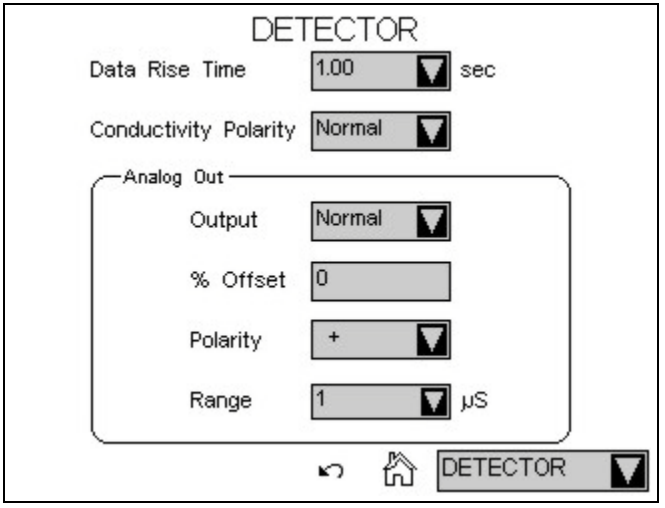


Figure B-17. Detector Page

B.9.1 Setting the Data Rise Time

The data rise time determines the amount of filtering performed on the conductivity data. The rise time is a measure of how quickly the detector responds to a change in signal, and is defined as the time it takes the output signal to rise from 10% of its final value to 90% of its final value.

The selected data rise time is used to filter both the digital data output, which is sent to the computer and the **PLOT** page, and the analog data output. The default rise time is 2 seconds.

Choosing an appropriate rise time value can optimize performance by keeping the signal-to-noise ratio at a minimum level. A longer rise time allows averaging of the noise frequencies, and subsequently, the baseline will contain much less short-term noise. However, longer rise times may have the following effects on peaks:

- Peak shape will become asymmetric.
- The peak maximum will be shifted.
- The peak height will be reduced.

The rise time should be approximately 25% of the peak width at one-half the height of the narrowest peak of interest.

For example, for a peak width of 5 seconds, calculate the rise time as: (5 sec) 25% = 1.25 sec. Because 1.25 seconds is not one of the available settings for rise time, select the next fastest rise time, 1 second.

To set the data rise time, touch the **Data Rise Time** field and select the desired time from the list (see Figure B-17).

B.9.2 Selecting the Conductivity Polarity

To change the polarity of the conductivity data, touch the **Conductivity Polarity** field. Select either **Normal** or **Inverted**. In applications in which the analyte output is lower than the background conductance, the polarity must be inverted to have peaks instead of dips on the chromatogram.

B.9.3 Setting Analog Out Options

The analog output connector on the Dionex ICS-1600 rear panel outputs an analog voltage signal proportional to the conductivity measured by the cell. The output is filtered using the selected data rise time (see Section B.9.1). The analog output can be connected to an analog-to-digital converter device, such as an integrator or a chart recorder.

The **Analog Out** options on the **DETECTOR** page (see Figure B-17) let you configure the output for your application.

- **Output**: Select **Normal** to output a signal corresponding to the offset conductivity reading from the detector (see "Conductivity Readings" on page 146) and the selected **Analog Out** parameters. Use the other two settings to calibrate an analog-to-digital converter device. Select **Zero** to set the output signal to zero volts. Select **Full Scale** to set the output signal to the full-scale voltage (1000 mV).
- **% Offset**: To adjust the zero position of the analog output when it is plotted, enter a percentage in the **% Offset** field. The value entered is a percentage of the full-scale analog output. An offset allows a recording device to plot the signal if it becomes negative. The offset percentage does not affect the magnitude of the output signal.
- **Polarity**: Select the polarity of the analog output signal: positive (the default settings) or negative. In applications in which the analyte output is lower than the background conductance, the polarity must be negative to have peaks instead of dips on the chromatogram.
- **Range**: Select the range in microSiemens (µS) of a full-scale detector response. For the Dionex ICS-1600, the full-scale voltage is 1000 mV. For example, if the range is 100 µS, then 1 µS is equal to 10 mV from the analog output. The range to use depends on the conductivity readings expected for the application.

B.10 Information Page

The **INFORMATION** page displays the version numbers of the Dionex ICS-1600 control programs (Moduleware and Boot Block), the serial number of the Dionex ICS-1600, and the options that are installed in the Dionex ICS-1600. The **INFORMATION** page is displayed at start-up. You can open the page from the menu of pages at any time.

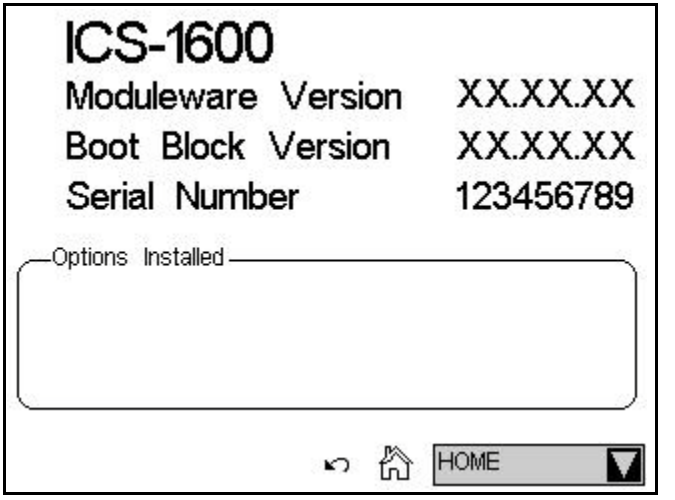


Figure B-18. Information Page

Moduleware is the firmware program installed in the Dionex ICS-1600 that controls instrument functions. Moduleware also sends status information and data to Chromeleon and receives control parameters from Chromeleon.

The Boot Block is the first program to be executed when the Dionex ICS-1600 power is turned on. It starts the Moduleware program.

B.11 Module Setup Page

The **MODULE SETUP** page lets you select options for the touch screen display and conductivity readings. To open this page, select **SETUP** from the menu of pages.

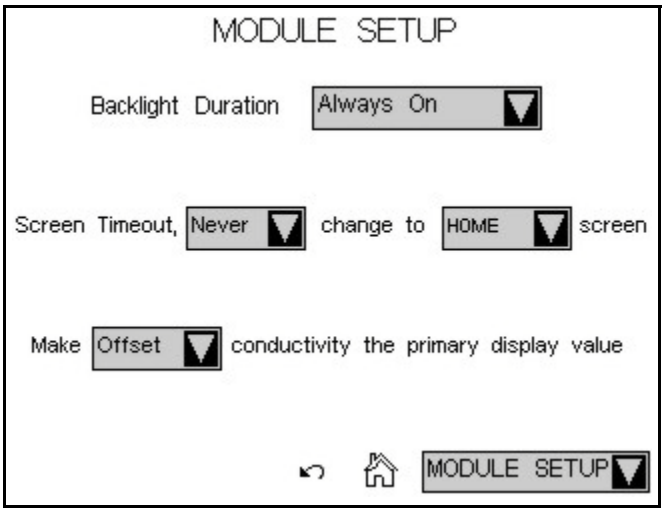
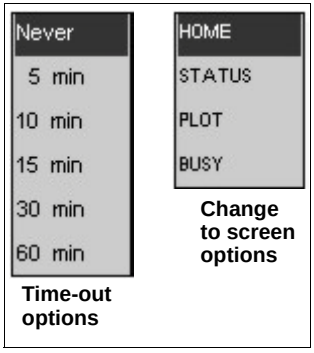


Figure B-19. Module Setup Page

Module Setup Options

- **Backlight Duration**: Select **2-hour time-out** to turn off the backlight after 2 hours if the touch screen is not used during that time. Select **Always On** to have the backlight remain on continuously.
- **Screen Time-out**: If the touch screen is not used during the selected time-out, the display will change to show the screen selected from the list. For example, if you select **5 min** and **BUSY**, the display will change to the **BUSY** page (see Figure B-10) 5 minutes after the last time the touch screen was used. Select **Never** to always display the page that was used last.



- **Conductivity Display**: Select either **Offset** (the default setting) or **Total** as the primary conductivity display value. The selected value is shown in large bold type on the **HOME** and **STATUS** screens, with the other value in smaller type.

B.12 Input/Output Page

The **INPUT/OUTPUT** page provides control of the Dionex ICS-1600 TTL inputs and TTL and relay outputs. To open this page, select **INPUT/OUTPUT** from the menu of pages. For details about relay and TTL control, see Appendix C.

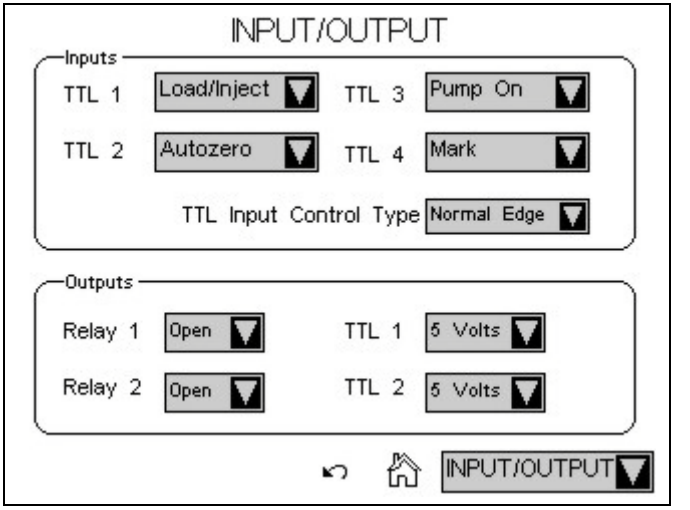


Figure B-20. Input/Output Page

B.13 Diagnostic and Calibration Pages

Diagnostic and calibration functions can be performed either from the touch screen diagnostic and calibration pages or from the Chromeleon Wellness Panel. To open a touch screen diagnostic or calibration page, select **DIAGNOSTIC** from the menu of pages. The **DIAGNOSTIC** page opens (see Figure B-21). From there, you can select the type of diagnostic or calibration to perform.

For detailed instructions on how to perform the various calibration and diagnostic procedures, see Section 5.1.

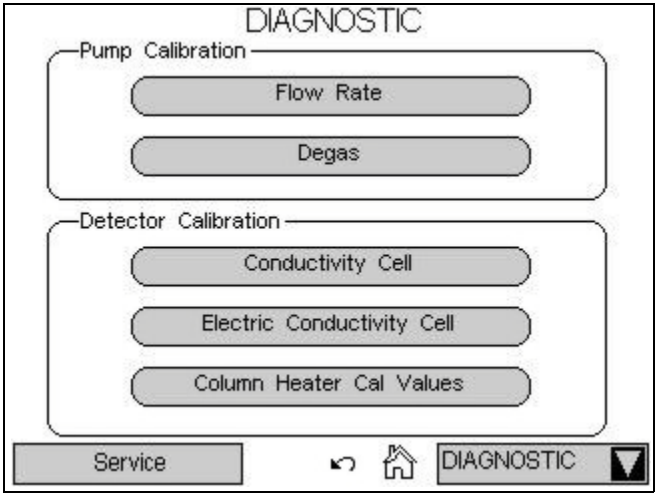


Figure B-21. System Diagnostic Menu Page

NOTE **The Service button provides access to service functions that are performed only by Thermo Fisher Scientific personnel. An access code is required to go to the service pages.**

C.1 TTL and Relay Connections

A 12-pin connector strip for TTL/relay control is located on the Dionex ICS-1600 rear panel. The connector provides two relay outputs, two TTL outputs, and four TTL inputs (see Figure C-1).

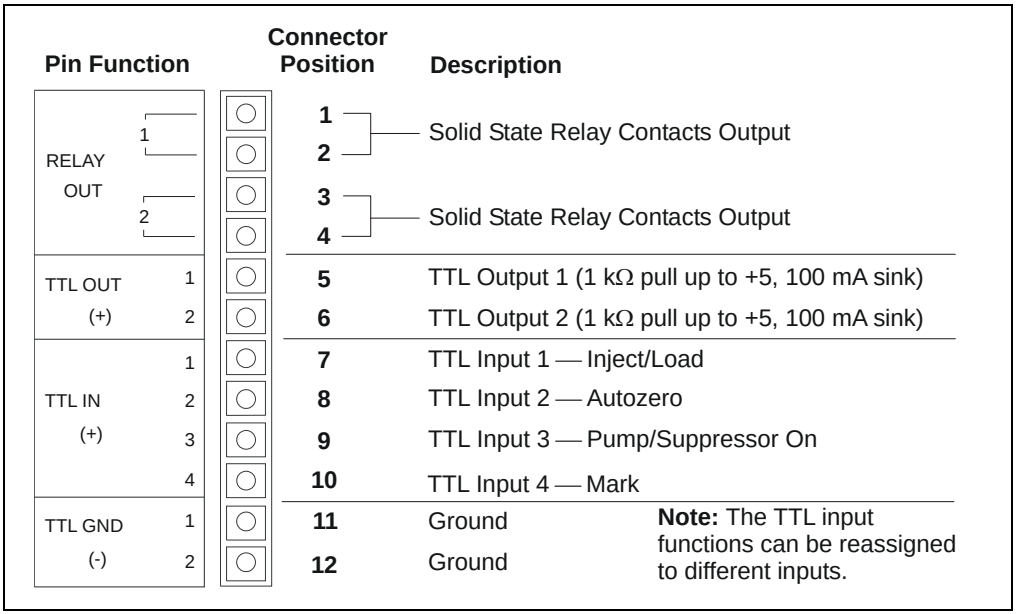


Figure C-1. TTL and Relay Connector on Rear Panel

IMPORTANT **Relay loads in excess of 200 mA or with included power supplies over 60 V may damage the relay drivers on the CPU.**

NOTE TTL 1 Input - Inject/Load applies only to the injection valve (not to the auxiliary valve, if installed).

The outputs can be used to control functions in external devices such as an autosampler or another Dionex module. When connected to a controlling device, the inputs can be programmed to perform the following Dionex ICS-1600 functions:

- Switch the injection valve position (load/inject)
- Perform an autozero command (set the conductivity to zero)
- Turn the pump on and off (also turns the suppressor on and off)
- Send a chart mark signal to the analog output. The mark is 10% of the full-scale voltage, and the duration is 0.5 seconds. A mark can be used, for example, to indicate the injection.

Relay outputs 1 and 2 can be programmed to switch any low-voltage control. Switched current must be less than 200 mA and 42 V peak.

Connecting a TTL or Relay

1. Locate the twisted pair of wires (P/N 043598) and the 12-position connector plug (P/N 923687) (see Figure C-2) in the Dionex ICS-1600 Ship Kit (P/N 067110).
2. Follow these basic steps to connect the TTL or relays.

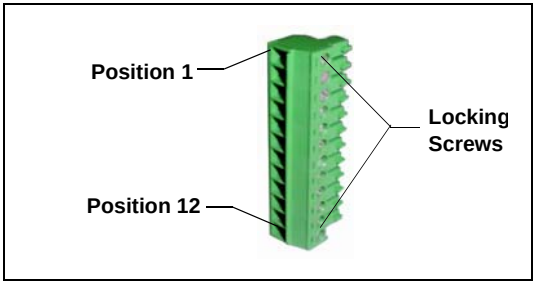


Figure C-2. 12-Position Connector Plug

   a. For each relay or TTL to be used, connect an active wire (red) and a ground wire (black) to the 12-position connector plug at the appropriate pin locations. Refer to Figure C-1 or the label on the Dionex ICS-1600 rear panel for the connector pin assignments.

      To attach a wire to the plug, strip the end of the wire, insert it into the plug, and use a screwdriver to tighten the locking screw. If necessary, multiple ground wires can be attached to a single TTL input/output ground pin.

IMPORTANT **When attaching wires to the connector plug, be careful not to allow stray strands of wire to short to the adjoining position on the connector.**

b. Plug the connector into the 12-pin connector on the Dionex ICS-1600 rear panel.

c. Connect the wires from the Dionex ICS-1600 connector plug to the TTL or relay connector pins on the other module(s). Additional connector plugs are provided with other Dionex modules.

NOTE Check the polarity of each connection. Connect signal wires to signal (+) pins and ground wires to ground (-) pins.

3. If you connected a TTL input, verify that the correct function is assigned to the input and that the correct input control type is selected. Select different settings, if necessary. Input functions and control types are assigned from either the **INPUT/OUTPUT** touch screen page or Chromeleon (see Section C.1.1).

C.1.1 Selecting TTL Input Functions and Control Types

To select TTL input functions and the control type from Chromeleon, open the Chromeleon Server Configuration program and double-click the Dionex ICS-1600 icon under the timebase. Select the **TTL Inputs** tab (see Figure C-3).

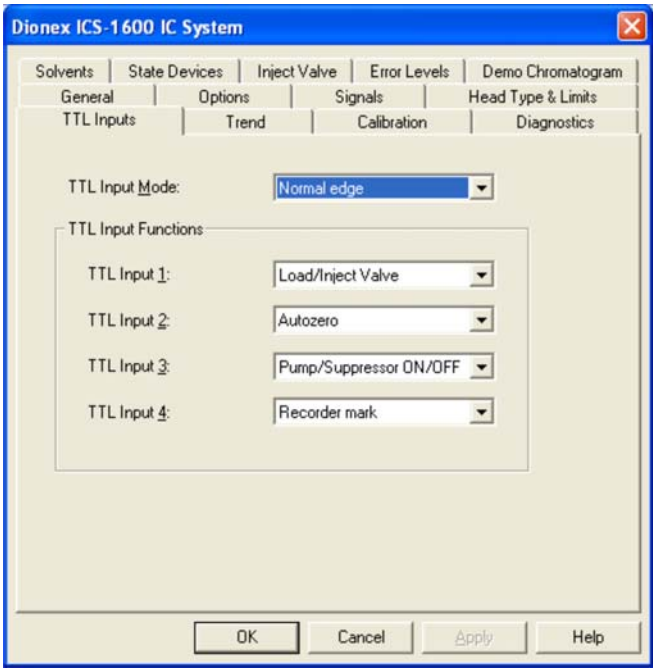


Figure C-3. Dionex ICS-1600 Server Configuration Properties: TTL Inputs

To select TTL input functions and the control type from the touch screen, go to the **INPUT/OUTPUT** touch screen page (see Figure C-4).

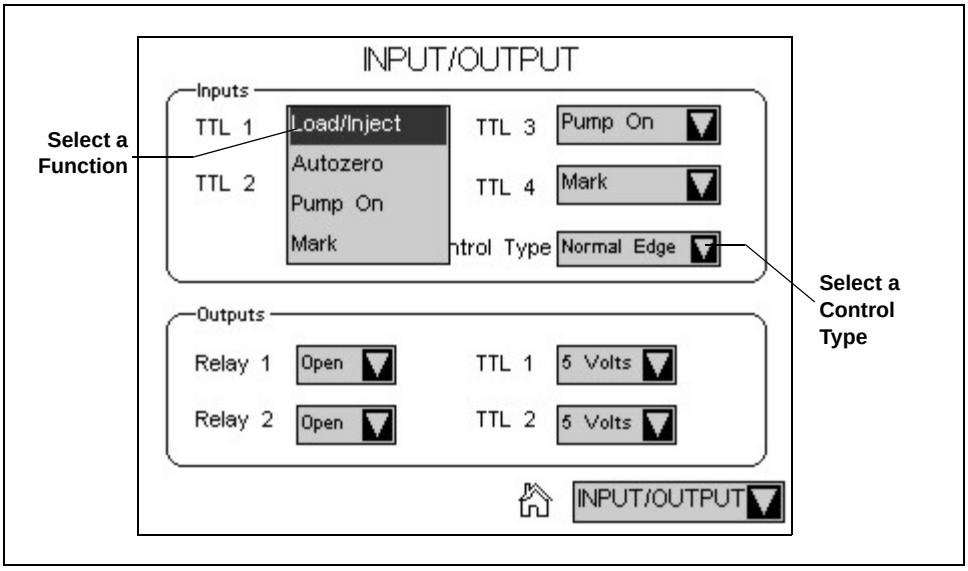
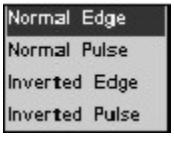


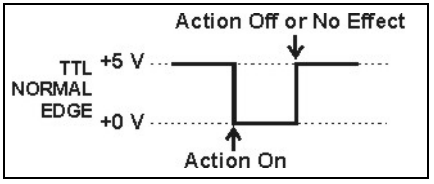
Figure C-4. Input/Output Page: Selecting TTL Functions

TTL Input Control Types



The Dionex ICS-1600 TTL inputs respond to four types of signals to accommodate different controlling devices. The default control type, **Normal Edge**, is compatible with the output signals provided by Dionex modules.

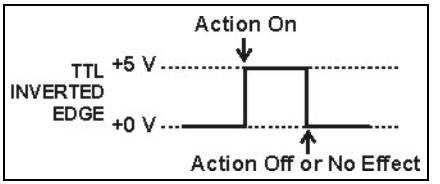
If the device connected to the Dionex ICS-1600 does not send a normal edge signal, select the appropriate control type. Refer to the documentation provided with the controlling device and the information below to select the correct type.



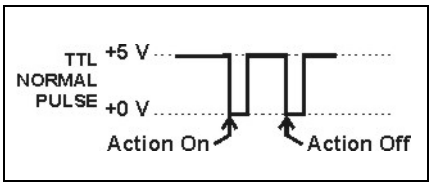
- *Normal Edge*: In normal edge operation, the negative (falling) edge of a signal turns on the function. For example, for the **Load/Inject** function, the negative edge switches the injection valve position to Load.

The action of the positive (rising) edge depends on the function: For the **Load/Inject** function, the rising edge switches the injection valve to the Inject position. For the **Pump On** function, the rising edge turns off the pump (and suppressor). For **Autozero** and **Mark**, the rising edge has no effect.

- *Inverted Edge*: The inverted edge mode works identically to the normal edge mode except that the positive and negative edges are reversed in function.

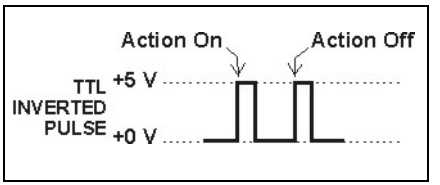


- *Normal Pulse*: In normal pulse operation, the negative (falling) edge of the TTL signal is the active edge and the positive (rising) edge is ignored.



A pulse width of 50 ms or more is guaranteed to be detected. A pulse width of 4 ms or less is guaranteed to be ignored. The action for pulse widths that are greater than 4 ms and less than 50 ms is undefined.

- *Inverted Pulse*: The inverted pulse mode operates identically to the normal pulse mode except that the positive and negative edges are reversed in function.



C.2 Controlling TTL and Relay Outputs

The Dionex ICS-1600 provides two TTL outputs and two relay contacts for control of functions in external devices, such as an integrator or autosampler. The relay outputs can be used to switch any low-voltage control. Switched current must be less than 200 mA and 60 V peak blocking. The relay-contact closures are normally open. When the relay is closed, current flows to the connected device.

IMPORTANT **Relay loads in excess of 200 mA or with included power supplies over 60 V may damage the relay drivers on the CPU.**

The TTL outputs are normally at 5 volts. Setting a TTL output to 0 volts turns on the action in the connected device.

The TTL and relay output states can be controlled from Chromeleon, either by issuing direct control commands from the Chromeleon Control panel or by including the commands in a control program.

To control the TTL and relay output states from the touch screen, select **INPUT/OUTPUT** from the menu of pages. The **INPUT/OUTPUT** page appears (see Figure C-4).

- To set a relay, touch the relay field and select the desired state (**Open** or **Closed**). For example, if Relay 1 is connected to the Load input on the autosampler, touch the **Relay 1** field and select **Closed** to start the load cycle.
- To set a TTL outputs, touch the **TTL** field and select the desired state (**5 Volts** or **0 Volts**).

C.3 Example Setup for Stand-Alone Operation

This section describes an example setup for *stand-alone operation* (operation without Chromeleon software) with a Dionex AS Autosampler and a third-party analog-to-digital converter and controller. If your configuration includes different devices, use the following steps as guidelines and refer to your product documentation for specific connection details.

Connect the Dionex AS Autosampler

Follow the instructions in the Dionex ICS-1600 installation instructions to connect the Dionex AS Autosampler to the Dionex ICS-1600 injection valve.

Connect the TTLs and Relays

1. Locate two twisted pairs of wires (P/N 043598) and 12-position connector plugs (P/N 923686) (see Figure C-5) in the Dionex ICS-1600 and Dionex AS Ship Kits.

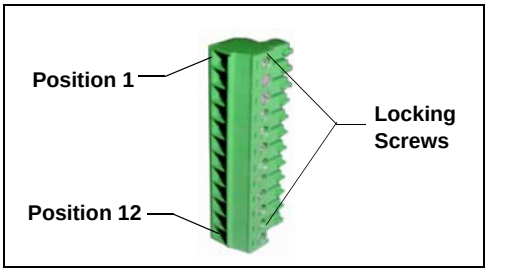


Figure C-5. 12-Position Connector Plug

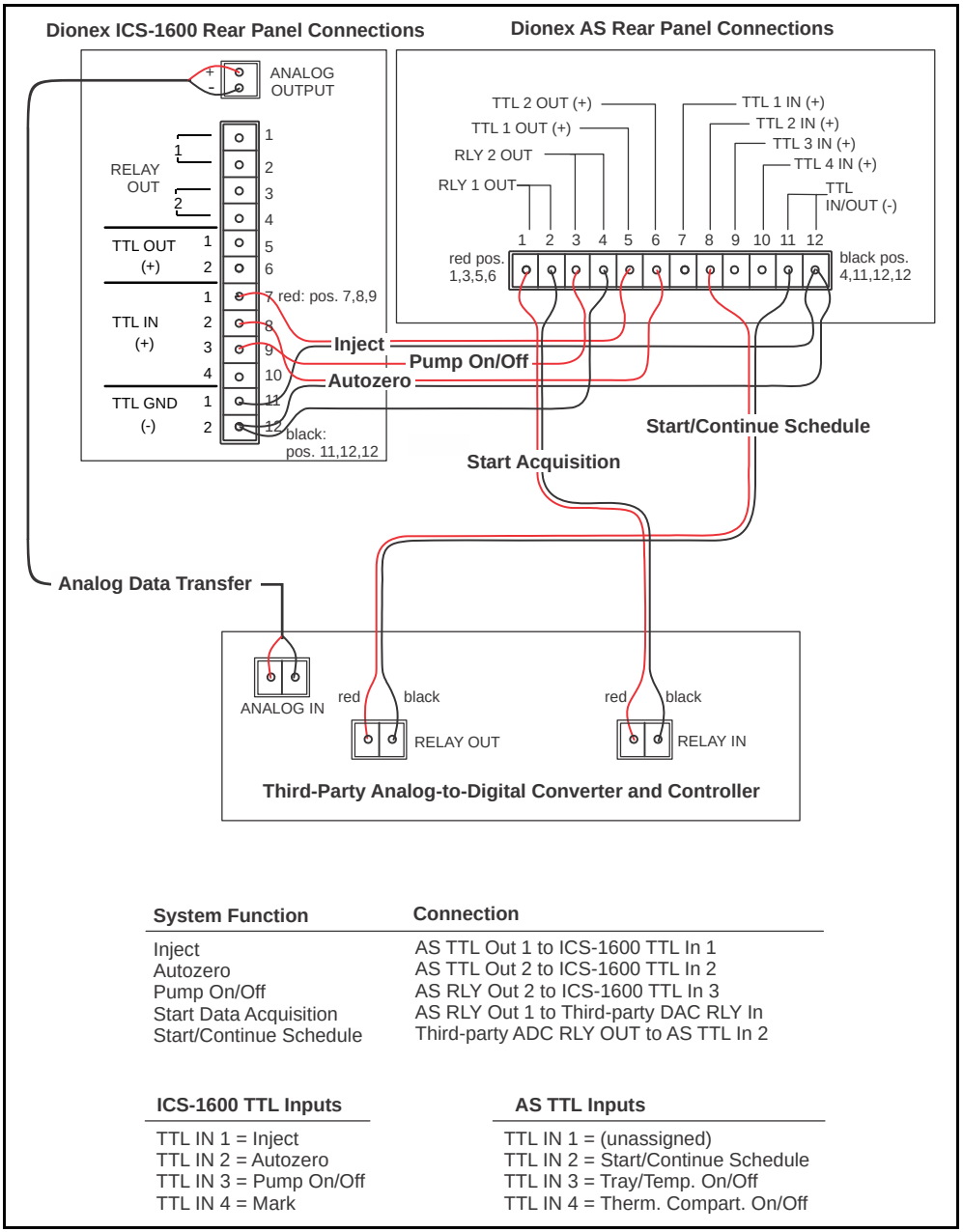
2. Attach the wires to the connector plug positions indicated in Figure C-6.

   To attach a wire to a connector plug, strip the ends of the wire, insert into the desired connector position, and tighten the locking screw with a screwdriver.

IMPORTANT **When attaching wires to the connector plug, be careful not to allow stray strands of wire to short to the adjoining position on the connector.**

3. Plug the connector plugs into their respective TTL/Relay connectors on the rear panel of each module.

   Make sure the red wires connect to active (+) pins on each module and the black wires connect to ground (-) pins.



System Function	Connection
Inject	AS TTL Out 1 to ICS-1600 TTL In 1
Autozero	AS TTL Out 2 to ICS-1600 TTL In 2
Pump On/Off	AS RLY Out 2 to ICS-1600 TTL In 3
Start Data Acquisition	AS RLY Out 1 to Third-party DAC RLY In
Start/Continue Schedule	Third-party ADC RLY OUT to AS TTL In 2

ICS-1600 TTL Inputs	AS TTL Inputs
TTL IN 1 = Inject	TTL IN 1 = (unassigned)
TTL IN 2 = Autozero	TTL IN 2 = Start/Continue Schedule
TTL IN 3 = Pump On/Off	TTL IN 3 = Tray/Temp. On/Off
TTL IN 4 = Mark	TTL IN 4 = Therm. Compart. On/Off

Figure C-6. Example Connections for Stand-Alone Operation

Assign Dionex ICS-1600 Input Functions

Go to the Dionex ICS-1600 **INPUT/OUTPUT** touch screen page and verify that the **Inject** function is assigned to TTL input 1, that Autozero is assigned to TTL input 2, and that the **TTL Input Control Type** is **Normal Edge** (see Figure C-7).

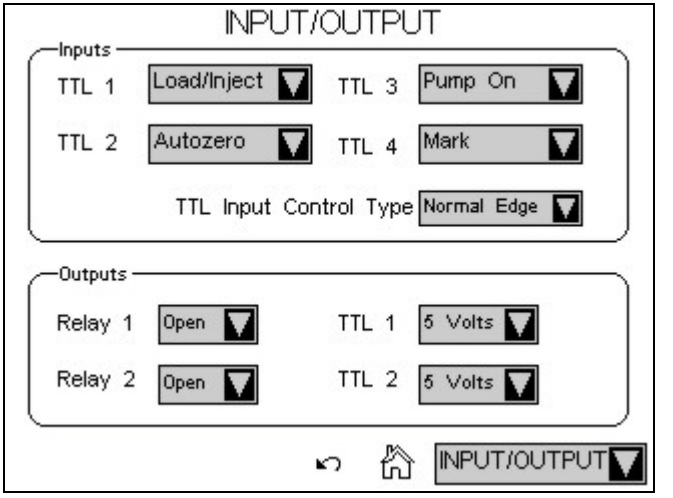


Figure C-7. Input/Output Page

Enable Dionex AS Control of the Injection Valve

1. On the Dionex AS front panel, press **Menu** and **0** to go to the **TIME FUNCTION OUT** screen. In the **LOAD/INJECT VALVE: TTL 1** field, select **ENABLED**.

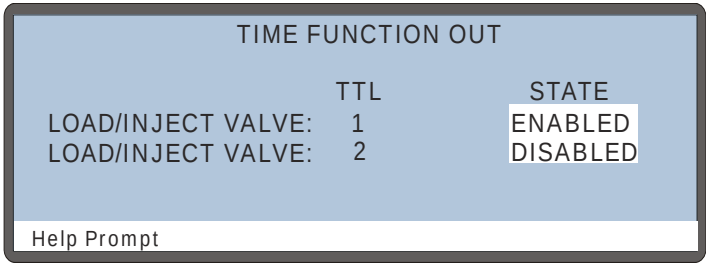


Figure C-8. Dionex AS Time Function Out Screen

2. Turn the Dionex AS power off and then back on.

   You can now issue commands from the Dionex AS to switch the Dionex ICS-1600 injection valve position.

Connect the Analog Output

1. Locate the analog cable for the third-party analog-to-digital converter and controller.
2. Connect the analog input connector on the third-party controller to the **ANALOG OUTPUT** connector on the Dionex ICS-1600 rear panel (see Figure C-6).

Configure the Dionex ICS-1600 Analog Output

Go to the Dionex ICS-1600 **DETECTOR** touch screen page and select the settings shown in Figure C-9:

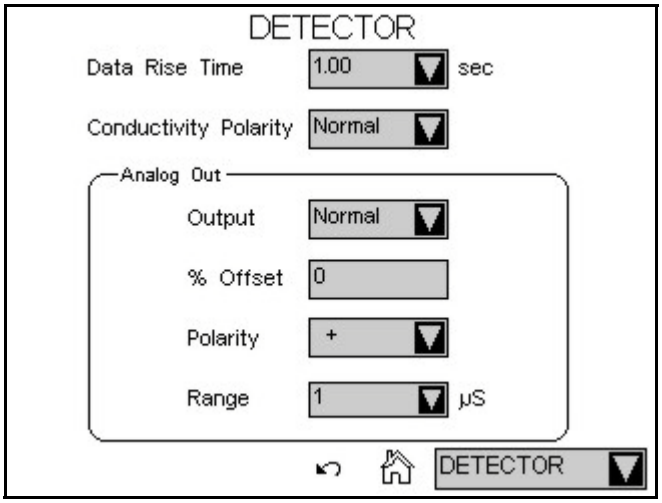


Figure C-9. Detector Page

Create a Dionex AS Method and Schedule

Figure C-10 is an example of Dionex AS method timed events that can be used with the TTL/Relay connections shown in Figure C-6.

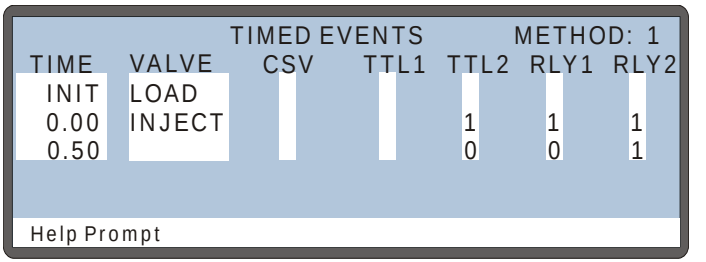


Figure C-10. Example Dionex AS Method for Stand-Alone Operation

Timed Event Notes:

- At time INIT, the injection valve is set to Load.
- At time 0.00, the injection valve is set to Inject, an autozero is performed (TTL2=1), the data acquisition mark is sent (RLY1=1), and the pump is turned on (RLY2=1).
- At time 0.5, TTL2 and RLY1 are switched back to 0 to be ready for the next run. RLY2 remains at 1 to keep the pump on.
- TTL1 does not need to be set in the timed events because the Load and Inject commands control the Dionex ICS-1600 injection valve automatically (see "Enable Dionex AS Control of the Injection Valve" on page 174).

To run the above method, set up a Dionex AS schedule. The example in Figure C-11 includes a four-point calibration (Lines 1–4) followed by two samples (Lines 5 and 6).

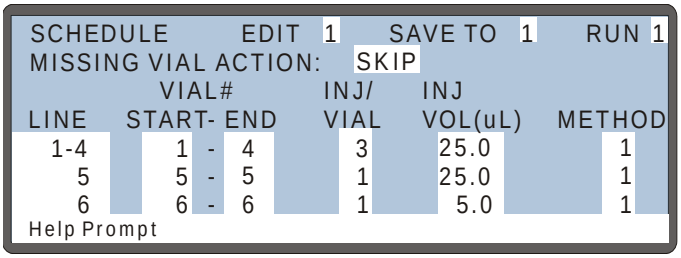

SCHEDULE EDIT 1 SAVE TO 1 RUN 1
MISSING VIAL ACTION: SKIP
LINE VIAL# START- END INJ/ VIAL INJ VOL(uL) METHOD
1-4 1 - 4 3 25.0 1
5 5 - 5 1 25.0 1
6 6 - 6 1 5.0 1
Help Prompt

Figure C-11. Example Dionex AS Schedule for Stand-Alone Operation

D • Reordering Information

Part Number	Item
	Reservoirs
046548	2-L plastic reservoir assembly (includes stopper and cap)
039164	4-L plastic reservoir assembly (includes stopper and cap)
	Pump
057937	Primary pump head assembly
057938	Secondary pump head assembly
045721	Outlet check valve assembly, 10-32
045722	Inlet check valve assembly, 1/4-28
045994	Check valve cartridges
052840	Piston
055870	Piston seal
048722	Piston rinse seal
055752	O-ring for waste valve or priming valve
057945	Eluent valve
079803	10 mL syringe (for priming eluent lines)
	Sample Loop and Injection Valve
042857	25-µL sample loop
057968	Injection valve
024305	Luer adapter fitting, 1/4-28 (for manual injections)
016388	1-mL syringe (for manual injections)
057896	Injection Valve Rebuild Kit
	Auxiliary Valve
069472	Auxiliary Valve Kit (6-port valve)
069473	Auxiliary Valve Kit (10-port valve)
057896	Injection Valve Rebuild Kit (for use with auxiliary valve, also)

Part Number	Item
061947	Auxiliary valve pod assembly (6-port valve)
061948	Auxiliary valve pod assembly (10-port valve)
	Suppressors, Cell, and Column Heater
056116	Dionex AAES Anion Atlas Electrolytic Suppressor
056118	Dionex CAES Cation Atlas Electrolytic Suppressor
064554	Dionex ASRS 300 4-mm Anion Self-Regenerating Suppressor
064556	Dionex CSRS 300 4-mm Cation Self-Regenerating Suppressor
064555	Dionex ASRS 300 2-mm Anion Self-Regenerating Suppressor
064557	Dionex CSRS 300 2-mm Cation Self-Regenerating Suppressor
057985	Dionex DS6 heated conductivity cell
069564	Column heater assembly
059979	Column heater heat exchanger, 0.25-mm (0.010-in) ID tubing
060943	Column heater heat exchanger, 0.125-mm (0.005-in) ID tubing (for use with 2-mm columns)
079910	Column heater cover assembly
052324	Microbore tubing kit
	Relay/TTL
923686	12-position connector plug
043598	Twisted pair of wires
	RFIC-ER Kits
069570	RFIC-ER Anion Startup Kit, ICS-1100/ICS-1600
067791	RFIC-ER Anion Consumables Kit, ICS-1100/ICS-1600
069569	RFIC-ER Cation Startup Kit, ICS-1100/ICS-1600
067792	RFIC-ER Cation Consumables Kit, ICS-1100/ICS-1600
070061	ER Tubing Kit
	Miscellaneous
954745	IEC 127 fast-blow fuses, rated 3.15 amps
060494	USB cable, 5 m (16 ft)
060392	External USB hub

Part Number	Item
	Preventive Maintenance Kits
057954	Dionex ICS-1600 Preventive Maintenance Kit
060581	Dionex AS Preventive Maintenance Kit
055647	Dionex AS-DV Preventive Maintenance Kit

E.1 How do I hook up an autosampler?

For instructions on how to connect the Dionex ICS-1600 to an autosampler, refer to the Dionex ICS-1600 installation instructions. Also refer to the autosampler operator's manuals, which are included on the Thermo Scientific Reference Library DVD (P/N 053891).

E.2 How do I print?

Click the **Print** toolbar button in Chromeleon.

E.3 Why are the retention times moving?

Retention times can shift if the pump flow is erratic or if the column or eluent is contaminated. See Section 4.7 for pump flow rate troubleshooting. If a contaminated column is suspected, clean the column as instructed in the column manual. The column manual is included on the Thermo Scientific Reference Library DVD (P/N 053891).

E.4 How do I adjust retention times?

Retention times are calculated during calibration. The **Use Recently Detected Retention Time** parameter in the Chromeleon QNT Editor (**General** tab) can be used to compensate for some types of retention time drifts; for example, evaporation of volatile components in pre-mixed solvents or an aging column. Refer to the Chromeleon Help or user's manual for details.

E.5 When should I remake standards?

Standards are used only for calibration and should always be made fresh (they have a lifetime of only one week).

E.6 When should I remake eluents?

Eluents should be remade every two or three weeks.

E.7 How do I start Chromeleon?

Click **Start** on the Windows taskbar, and then select **All Programs** > **Chromeleon** > **Chromeleon**.

E.8 How do I delete data?

In the Chromeleon Browser, highlight the sequence you want to delete and then select **File** > **Delete**.

E.9 How do I back up data?

In Chromeleon, select **File** > **Export/Backup**. Back up the data and indicate the backup source.

E.10 How do I shut off the system?

In Chromeleon, click the **System Shutdown** button on the Dionex ICS-1600 Control panel. On the instrument, turn off the power switch on the rear panel (see Figure 2-10).

E.11 How do I store columns?

Columns should be stored in eluent. See the column manual for complete instructions. The column manual is included on the Thermo Scientific Reference Library DVD (P/N 053891).

E.12 How do I know when a column is dirty?

See the troubleshooting section of the column manual.

E.13 How do I clean a column?

See the troubleshooting section of the column manual.

E.14 Why is the conductivity high?

Possible reasons for high conductivity include:

- The suppressor is not on. Turn on the suppressor from the Chromeleon Control panel or the Dionex ICS-1600 touch screen **SUPPRESSOR** page.
- The suppressor needs regeneration. See the suppressor manual for troubleshooting information. The suppressor manual is included on the Thermo Scientific Reference Library DVD (P/N 053891).
- The cell is out of calibration. See Section 5.1.3 for calibration instructions.
- See Section 4.13 for additional troubleshooting information.

E.15 How do I configure and operate the auxiliary valve?

See *Installing the ICS-1100/ICS-1600/ICS-2100 Auxiliary Valve* (Document No. 065288), provided in the Auxiliary Valve Kit.

Analytical Column
Synonymous with **Separator Column**.

Band Spreading
The broadening of the sample band as it travels through the column. Band spreading can also occur in the injection valve, detector cell, and interconnecting tubing.

Calibration Curve
A graph showing detector response in peak height or area versus analyte concentration.

Capacity Factor (k´)
The number of column volumes of eluent, pumped through the column, required to elute an analyte. Capacity factor is a dimensionless measure of retention which is independent of column length or eluent flow rate. It is calculated as follows:

$$k' = \frac{t_r - t_o}{t_o}$$

Where: t_r = retention time
t_o = retention time of unretained solute (column void volume)

Cell Constant (k)
A factor determined experimentally by measuring the conductance (G) of a standard solution of known equivalent conductivity (k).

$$k = \kappa / G$$

The value of k depends upon the surface area of, and distance between, the electrode faces in the conductivity detector cell.

$$k = l / A$$

Where: l = length
A = area of one electrode (the other electrode is equal to the first)

Channeling
The preferential flow of liquid along more open, less resistant paths through the column packing. This causes **Band Spreading**.

Column Efficiency (N)
A measure of the *narrowness* of analyte bands as they elute from the column. High efficiency is desirable because resolution between closely spaced bands improves with greater efficiency. For a symmetrical (Gaussian) peak, column efficiency can be determined by the following:

$$N = 5.54(t_1/W_{1/2})^2$$

Where: t_1 = the peak retention time (in seconds)
$W_{1/2}$ = the peak width at 1/2 height (in seconds)

Column efficiency is proportional to column length: for a given resin and column diameter, increasing the column length increases the column efficiency. Synonymous with **Theoretical Plates**.

Column Selectivity (a)
Describes the relative separation of the band maxima between two adjacent peaks. Selectivity can be determined by the following:

$$a = (t_2 - t_0)/(t_1 - t_0)$$

Where: t_1 and t_2 = retention time of components 1 and 2, respectively
t_0 = retention time of unretained components (void volume)

Concentrator Column
A short column used to retain and concentrate analytes from a measured volume

of relatively clean sample. This allows large volumes of sample to be injected, lowering concentration detection limits.

Conductivity
A measure of the ease with which electrical current flows through a liquid contained between two opposite charged electrodes. Conductivity is a characteristic of ions in solution. Units are siemens.

Counterion
Ions carrying a charge opposite that of the sample ions (e.g., Na^+) may be the counterion of a Cl^- analyte. These ions preserve electrical neutrality in solution.

% Crosslink
Divinylbenzene content in a polystyrene/divinylbenzene (PS-DVB) resin; this contributes to the mechanical strength of the resin and determines chromatographic properties.

Equivalent Conductivity (λ)
The contribution of an ionic species to the total conductivity of a solution as measured in a standard cell having electrodes 1 cm^2 in area and exactly 1 cm apart.

Guard Column
A small column that prevents poisoning of the separator column by sorbing organic contaminants and removing particulates. It is filled with the same packing as the separator column. Synonymous with **Pre-Column**.

HETP (H)
Height **E**quivalent to a **T**heoretical **P**late. A measure of column efficiency which allows comparison between columns of different lengths.

$$HETP = H = L/N$$

Where: L = the column length (in mm)
N = the number of theoretical plates

Ion-Exchange Capacity
The number of active ion exchange sites in a given weight or volume of resin; this is usually expressed in meq/g or meq/mL.

Ion-Exchange Resin
An insoluble polymer matrix containing fixed-charge exchange sites (anionic or cationic). IC resins are formed into small spherical particles (beads).

Packing
The material that fills a chromatographic column; usually a resin or silica-based material.

Pellicular Resin
A resin with a solid, nonporous core coated with a thin layer of more porous material. The exchange sites of pellicular ion exchange resins are located only on the surface layer of the bead. These resins have a low ion-exchange capacity.

Pre-Column
Synonymous with **Guard Column**.

Regenerant
A dilute acid or base that converts ion exchange sites in a MicroMembrane Suppressor back to the form that suppresses the eluent conductivity.

Resin
See **Ion-Exchange Resin.**

Resolution (R)
A measure of the separation between two sample components. This is expressed as the ratio of the distance between the two peak maxima to the mean value of the peak width at the baseline.

$$R = 2(t_2 - t_1)/(W_2 + W_1)$$

Where: t_1 and t_2 =the retention times of components 1 and 2, respectively
W_1 and W_1 = the baseline width of peaks 1 and 2, respectively (measured in the same units as the retention time)

R is proportional to the square root of efficiency (N). A value of R = 1.5 represents “baseline separation” of the two peaks.

Retention Time
The time from injection to peak maximum; the basis for identification of a species in chromatographic analysis.

Separator Column
The column used to perform a chromatographic separation; also called an analytical column.

Siemens (S)
Unit measure of conductance; the reciprocal of the electrical resistance of a solution.

Suppressor
A device used to minimize eluent conductivity and convert sample species to a common form, thus increasing detection sensitivity.

Temperature Coefficient
The percent of change in the conductivity of a solution with a 1 ^{o}C change in temperature. Every solution has a characteristic temperature coefficient which is determined experimentally.

Theoretical Plates (N)
See **Column Efficiency**.

Void Volume (V_0)
The volume occupied by the eluent in a packed column. This volume includes the volume between the injection valve and the column, as well as between the column and the detector cell. Unretained components are eluted in the void volume.

Index

Symbols

% Offset (analog out), 159

A

Adjusting the contrast, 12, 139
Air particulate samples, 51
Alarm conditions, 63 – 70
    See also Error messages
Ambient temperature, 81
Analog output, 157, 159, 166
    % Offset, 159
    Configuring, 159, 175
    Connections, 175
    Connector, 20
    Full-scale, 159
    Range, 159
Analog-to-digital controller, 175
Anion separations, 50
Application Wizard, 57
AS Autosampler, 52
    Connections for stand-alone operation, 172
    Enabling injection valve control, 174
    Maintenance, yearly, 59
    Method for stand-alone operation, 176
    Sample injection, 54
    Schedule for stand-alone operation, 176
    Time Function Out screen, 174
AS-DV Autosampler, 53
    Maintenance, yearly, 60
    Sample injection, 54
AS-HV Autosampler, 53
Atlas Electrolytic Suppressor, 18
    See also Suppressor
Audit Trail
    Error messages, 61
    Icons, 61
Autosampler
    Loading samples with, 54
    See also AS Autosampler
    See also AS-DV Autosampler
Autosampler Control panel, 27
Autosampler specifications
    Automated dilution, 136
    Automation, 136
    Automation flexibility, 136
    Online filtration, 136
    Online sample degassing, 136
    Semiautomated system qualification, 136
    Sequential/Simultaneous injection, 136
Autozero, 49, 56, 146
Auxiliary valve, 17, 34, 52
    Applications, 34
    Configuration, 52
    Does not switch position, 68
    Installation instructions, 34
    Leaking, 72
    Maintenance, yearly, 59
    Passages blocked, 78
    Rebuilding, 99
    Reordering, 177
    Replacing the mechanical part (pod), 99 – 100
    Troubleshooting, 68

B

Background conductivity
    High, 80
    Offsetting, 49, 146, 148
Backlight
    Time-out, 161
Backpressure, 32
    Restriction in plumbing, 95
    Troubleshooting, 77

Bar, 154
Baseline
  Drift, 81
  Noise, 22, 24, 81, 158
  Stability, 36
  Zeroing, 146
Batch processing, 40
Blockages
  Liquid lines, 67, 95
Bottle
  See Reservoir
Busy page, 161

C

Cables
  Power cord, 127
Calibration, 85
  Conductivity cell, 89
  Flow rate, 92
  Vacuum degas assembly, 94
Cation separations, 50
Cell
  See Conductivity cell
Cell calibration, 89
Cell heater, 146
Check valves
  Cleaning procedure, 103 – 104
  Replacement procedure, 103 – 104
Chromatogram, 3
  Zeroing the baseline, 146
Chromeleon, 26
  Alarm conditions, 63
  Application Wizard, 57
  Audit Trail, 61
  Audit Trail error messages, 61
  Commands, 56
  Control panel, 55
  Degas options, 82
  Error messages, 63
  Interface, 26
  Menu, 55
  Overview, 26
  Panel tabset, 26
  Programs, 54
  Quantification method, 58
  Starting, 42
  Timebase, 26
  Toolbars, 55
  Using the touch screen with Chromeleon, 142
  Wellness panel, 85
Chromeleon Server
  Starting, 42
Chromeleon Server Monitor, 42
Column heater, 18, 35
  Home page control, 145
  Replacement procedure, 116
  Specifications, 134
Column heater alarms
  Column heater exceeds safe temperature, 63
  Column heater open circuit, 64
  Column heater short circuit, 64
Columns, 18
  Cleaning, 182 – 183
  Contaminated, 79
  Damage from IPA, 127
  Storing, 182
Component panel, 16
Conductivity, 146
  Causes of high conductivity, 183
  Changing the display, 161
  Offset, 146, 161
  Temperature effect, 36
  Total, 146, 161
Conductivity cell, 17 – 18, 36
  Calibrating, 89
  Calibration constant, 113
  High cell output, 80
  Leaking, 72
  No response, 79
  Replacement procedure, 112
  Setting the temperature, 146
  Volume, 36
Conductivity cell specifications
  Active volume, 133

Cell body, 133
Chemical compatibility, 133
Electrodes, 133
Maximum pressure, 133
Temperature, 133
Conductivity polarity, 158
Contacting Thermo Fisher Scientific, 8
Contamination
Column, 77, 79
Eluents, 78
Sample, 79
Standard, 78
Control panel (Chromeleon), 26, 55
Autosampler, 27
Sequence Control, 27
Status, 27
Current, 156

D

Daily maintenance, 58
Data
Backing up, 182
Deleting, 182
Filtering, 158
Saving, 55 – 56
Data acquisition, 55
Data analysis description, 3
Data rise time, 157 – 158
Decibel level, 129
Default panel tabset, 27
Degas tubing assembly
See Vacuum degas assembly
Degas calibration failed alarm, 64
Degassing eluents, 28, 44
Detection description, 3
Detector controls on Home page, 146
See also Conductivity cell
Detector page, 157
Setting analog out options, 159
Setting the data rise time, 158
Detector specifications
Auto offset, 132
Calibration, 132
Cell drive, 132
Control and data evaluation, 132
Linearity, 132
Range, 132
Resolution, 132
Temperature compensation, 132
Diagnostic pages, 162
Diagnostics, 85
Dimensions, 129
Dionex, 42
Direct software control, 27
Drip tray, 17
DS6 Heated Conductivity Cell
See Conductivity cell
Duty cycle, 29, 155

E

Elapsed time, 146, 148
Electrical specifications
Fuses, 129
Main power, 129
Eluent
Aqueous, 59, 74
Degassing, 28
Delivery process, 2
Filtering, 45
Preparing, 44
When to remake, 182
Eluent bottle
See Eluent reservoir
Eluent level, 45, 145
Eluent reservoir
Connecting, 47
Monitoring liquid level in, 45, 145
Storage on top cover, 15
Eluent valve, 18, 155
Replacing, 120
End-line filter
See Filter, end-line
Environmental specifications, 130
Equilibration time, 49

ER Controller (ERC 10), 19, 37
Error messages, 63 – 70
Audit Trail description, 61
Column heater exceeds safe temperature, 63
Column heater open circuit, 64
Column heater short circuit, 64
Degas calibration failed, 64
Hardware not present, 64
Leak sensor wet, 65
Load/inject valve error, 65
Option not installed, 66
Pump motor lost control, 66
Pump over pressure, 67
Pump pressure hardware error, 66
Pump stopped due to lost USB communication, 68
Pump under pressure, 68
Second valve error, 68
Suppressor not connected, 69
Suppressor over current, 69
Suppressor over power, 70
Suppressor stopped for zero flow rate, 70

F

Filter, end-line
Bacterial contamination, 59, 74
Dirty or clogged, 59, 74
Installation, 45
Filtering data, 158
Fittings
Leaking, 71
Replacing, 98
Requirements, 98
Flow rate, 17, 130, 145
Calibration, 92
Troubleshooting, 75
Front panel, 11
See also Touch screen
Full-scale analog output, 159
Fuses
Replacement procedure, 127
Requirements, 129

G

Ghosting, 78
Guard column, 18

H

Hardware not present error, 64
Heater, column, 35
See also Column heater
High pressure alarm, 67
Home page, 12, 139, 144 – 147
Column Heater control, 145
Detector controls, 146
Injection valve controls, 146
Pump controls, 144
Humidity, operating, 130

I

Information page, 160
Injecting samples, 52
Via autosampler, 54
Via syringe, 53
Via vacuum syringe, 54
Injection port, 11
Injecting via syringe, 53
Injection valve, 17, 32
Controlling with a Dionex AS, 174
Home page controls, 146
Leaking, 72
Passages blocked, 78
Plumbing connections, 33
Rebuilding, 99
Specifications, 133
Troubleshooting, 65
Input/Output page, 162, 174
Installation
Analog output connection, 175
Priming, 123, 125

Stand-alone operation setup, 172 – 173
TTL and relay connections, 165 – 166
Installed options, 160
Inverted edge TTL input control, 170
Inverted peaks, 158
Inverted pulse TTL input control, 170
Ion chromatography overview, 1
Ion exchange, 3
Isocratic delivery system, 2
Isopropyl alcohol, 126 – 127

L

LCD screen, 11 – 12, 139
Specifications, 130
See also Touch screen
Leak sensor, 17
Leak sensor wet alarm, 65
Replacement, 122
Leaks
Auxiliary valve, 72
Cell, 72
Fittings, 71
Injection valve, 72
Liquid, 71
Pressure transducer, 72
Pump check valve, 71
Pump head, 71
Pump head waste valve, 72
Pump piston seal, 71
Suppressor, 72
LED, 130
Linearity requirements, 132
Liquid leaks, 71
See also Leaks
Load/inject valve alarm, 65
Loading samples, 52
Local Mode, 147
Locked Remote mode, 142
Loop
See Sample loop

M

Main power receptacle, 21
Maintenance, 58
Daily, 58
Ongoing, 58
Weekly, 59
Yearly, 59
Manual sample processing, 40
MicroMembrane Suppressor, 18
See also Suppressor
Module Setup page, 161
Moduleware, 61, 160
MPa, 154

N

Nitrite in samples, 51
Noise, baseline, 158
Normal edge TTL input control, 169
Normal pulse TTL input control, 170

O

Offset conductivity, 161
Offset percentage (analog out), 159
Offsetting background conductivity, 49, 146
Operating features, 11
Operating humidity, 130
Operating ranges
Cell heater, 17, 146
Column heater, 18, 145
Flow rate, 17, 145
Operating temperature, 130
Operation
Equilibration time, 49
Overview, 39
Priming, 47, 125 – 126
Reservoir setup, 44
Sample preparation, 50
Sample processing, 40
Setting operating conditions, 48
Starting Chromeleon, 42

System power-up, 41
Operational status verification, 49
Option not installed error, 66
Options installed, 160
Oven
See Column heater
Overview of system, 4

P

Panel tabset, 26
How to display, 27
Panels
Chromeleon Control panel, 55
Chromeleon Wellness panel, 85
Component panel, 16
Parameters
Chromeleon operating commands, 56
Peak ghosting, 78
Peak height
Effect of rise time on, 158
Reproducibility, 36
Troubleshooting, 79
Peak shape, 158
Peak width, 158
Peaks
Effect of rise time on, 158
Extraneous (ghosting), 78
Inverted, 158
Reversed, 158 – 159
PEEK
Conductivity cell body, 36
PGM file
See Programs
Physical specifications
Decibel level, 129
Dimensions, 129
Weight, 129
Piston seals
Replacement procedure, 105 – 106
Pistons
Replacement procedure, 109
Plot offset, 148
Plot page, 147 – 148
Elapsed time, 148
Plot offset, 148
Range, 148
Plotting detector output, 148
Plumbing
Injection valve, 100
Replacing tubing and fittings, 98
Troubleshooting, 95
Polarity
Selecting the conductivity polarity, 158
Power
Turning on, 41
Power cord, 127
Power receptacle, 21
Power requirements, 129
Power-up conditions, 41
Pressure
Home page display, 144
Limit, 68, 144, 153
System, 68, 153
Unit (selecting), 153
Pressure transducer, 17, 32
Leaking, 72
System backpressure, 32
Prime button, 145
Priming, 47, 123, 125 – 126
Pump is out of prime, 74
With a syringe, 123
With isopropyl alcohol, 126
With the Prime button, 125
Priming valve
Opening, 30
O-ring replacement procedure, 110
Printing, 181
Problems
See Troubleshooting
Processing samples, 40, 55 – 56
Automatically (batch), 40, 56 – 57
Manually, 40, 55
Product warranty, 85, 99 – 100
Programmed software control, 27
Programs (Chromeleon), 27
Controlling an autosampler, 54

PSI, 154
Pulse damper, 22, 24, 32
Pump, 30
  Flow rate, 17, 145
  Home page controls, 144
  Leaks, 71
  Over pressure alarm, 67
  Primary pump head, 30
  Priming, 47, 123
  Priming problems, 73
  Secondary pump head, 31
  Selecting the pressure unit, 153
  Setting pressure limits, 153
  Stopped due to lost USB communication, 68
  Troubleshooting, 75
  Under pressure alarm, 68
Pump check valve leaking, 71
Pump degas
  See Vacuum degas assembly
Pump head waste valve
  Leaking, 72
  O-ring replacement procedure, 110
Pump heads, 103
Pump motor lost control alarm, 66
Pump page, 153
  Changing the pressure unit, 153
  Setting degas parameters, 154
  Setting pressure limits, 153
Pump pressure hardware error, 66
Pump priming valve
  O-ring replacement procedure, 110
Pump specifications
  Construction, 130
  Delay volume, 130
  Eluent bottle pressure, 130
  Eluent generation, 130
  Flow accuracy, 130
  Flow precision, 130
  Flow rate, 130
  Gradient capabilities, 130
  Operating pressure, 130
  Pressure ripple, 130
  Type, 130
  Vacuum degasser, 130

Q

Quantification method, 58

R

Range, 148, 159
Rear panel, 20
  Analog output connector, 20
  Power receptacle, 21
  USB connections, 20
Rebuilding the auxiliary valve, 99
Rebuilding the injection valve, 99
Recorders
  Analog output setting, 159
Relay connections
  Rear panel connector, 21, 165
Relay outputs
  Controlling, 171
  Voltage and current specifications, 166
Remote Mode, 147
Reordering information, 177
Reproducibility, 36
Reservoir
  Connecting, 47
  Monitoring liquid level in, 45
  Storage on top cover, 15
Restriction in liquid lines, 67, 95
Retention time
  Adjusting, 181
  Moving, 181
  Troubleshooting, 79
Reverse peaks, 158
RFIC-ER compartment, 19
RFIC-ER Kits, 19
RFIC-ER mode
  Components required, 19
  Flow schematics, 22
  Specifications, 132
Rise time, 158

Running samples, 55
See also Processing samples

S

Safety messages, 6
Sample loop, 17, 32 – 33
Changing, 98
Injecting, 33
Injection valve connections, 33, 99
Loading, 33
Reordering, 177
Sample processing, 40, 55 – 56
Batch, 40, 56
Manual, 40, 55
With Chromeleon, 55 – 56
Samples
Collecting and storing, 50
Diluting, 51
Filtering, 51
Injecting, 52, 54
Loading, 52
Pretreating, 51
Saving data, 55 – 56
Seal replacement, 106
Second valve
Troubleshooting, 68
Second valve error, 68
Selectivity
Troubleshooting, 79
Self-Regenerating Suppressor, 18
See also Suppressor
Separation process, 3
Separator column, 18
Sequence Control panel, 27
Sequence Wizard, 58
Server Configuration program
Starting, 42
Service chase, 15, 18
Service procedures, 104
Check valve cleaning, 103 – 104
Check valve replacement, 103
Conductivity cell replacement, 112
Fuse replacement, 127
Injection valve rebuilding, 99
Isolation of liquid lines restriction, 95
Leak sensor replacement, 122
Piston replacement, 109
Piston seal replacement, 105
Priming valve O-ring replacement, 110
Rebuilding the auxiliary valve, 99
Rebuilding the injection valve, 99
Replacing tubing and fittings, 98
Suppressor replacement, 115
Tubing and fittings replacement, 98
Waste valve O-ring replacement, 110
Signal-to-noise ratio, 158
Software control, 26
Modes of, 27
Software specifications
Application templates, 136
Automated procedure wizards, 136
Automation support for third-party vendors, 136
Customizable system control panels, 136
Customized reporting, 137
Daily Audit Trail, 136
Multiple network control, 137
Network failure protection, 137
Power failure protection, 136
Sample Audit Trail, 136
Sequential injection, 136
Storage of calibration settings, 137
System status virtual channels, 136
System trigger commands and conditionals, 136
System Wellness and Predictive Performance, 136
Virtual column simulator, 136
Specifications
Autosampler, 136
Column heater, 134
Conductivity cell, 133
Detector, 132
Electrical, 129
Environmental, 130
Injection valve, 133

LCD touch screen, 130
Physical, 129
Pump, 130
Supressors, 135
System software, 136
Vacuum degas assembly, 134
Stand-alone operation, 172 – 176
Analog output connection, 175
AS setup, 174, 176
Example connections, 173
TTL and relay connections, 172
Standards
When to remake, 181
Status Control panel, 27
Status page, 147, 149
Sulfite in samples, 51
Suppression description, 3
Suppressor
Controlling the current to, 156
Description, 18, 36
Leaking, 72
Replacement procedure, 115
Selecting the type, 156
Suppressor alarms
Suppressor not connected, 69
Suppressor over current, 69
Suppressor over power, 70
Suppressor stopped for zero flow rate, 70
Suppressor page, 156
Supressor specifications
Chemical suppression, 135
Displacement chemical regeneration, 135
Electrolytic suppression, 135
Sequential suppression for anions, 135
Suppression capacity, 135
Suppressor wear parts, 135
Void volume, 135
Syringe injection, 53
Vacuum, 54
System
Shutdown, 182
Startup, 41
Status, 49
System backpressure, 32
System components
Descriptions, 28
System overview, 4
System Wellness, 27

T

Technical Support, 8, 61, 85
Temperature
Cell heater, 36, 146
Column heater, 18, 35, 145
Minimizing the effect of variations, 36
Temperature compensation, 36
Temperature, operating, 130
Thermo Fisher Scientific
Contacting, 8
Thermo Fisher Scientific Technical Support, 8, 61, 85
Timebase, 26
Time-out (screen), 161
Top cover, 15
Total conductivity, 146, 161
Touch screen, 11, 139
Adjusting the contrast, 12, 139
Number keypad, 13, 140
Operation, 12, 139
Specifications, 130
Time-out, 161
Using with Chromeleon, 142
Touch screen pages
Busy page, 161
Detector page, 157
Diagnostic pages, 162
Home page, 12, 139, 144, 146 – 147
Information page, 160
Input/Output page, 162, 174
Module Setup page, 161
Overview, 143
Plot page, 147 – 148
Pump page, 153
Status page, 147, 149
Suppressor page, 156

Troubleshooting, 61
Alarm conditions, 63
Baseline noise or drift, 81
Calibrations, 85
Diagnostics, 85
Error messages, 63
Excessive backpressure, 77
Flow rate, 75
High cell output, 80
Liquid leaks, 71
No cell response, 79
Peak ghosting, 78
Peak height, 79
Pump, 73 – 75
Retention time, 79
Selectivity, 79
Vacuum degas assembly, 82
TTL and relay connector, 165
Connection instructions, 166
Pin assignments, 165
TTL inputs
Assigning functions to, 169, 174
Control type, 174
Default function assignments, 166
Rear panel connector, 21
TTL outputs
Controlling, 171
Rear panel connector, 21
Tubing
Replacing, 98
Requirements, 98
Routing clips, 21
Tubing connections
Isolating a restriction, 67, 95

U

USB connections, 20

V

Vacuum degas assembly, 28
Calibration, 94
Components, 28
Fails to run, 82
Setting operating parameters, 154
Specifications, 134
Troubleshooting, 73
Valve
See Auxiliary valve
See Eluent valve
See Injection valve
See Waste valve
Version number, 160

W

Warranty, voiding, 85, 99 – 100
Waste lines
Blocked, 71
Waste valve, 31
Opening, 31, 105
O-ring replacement procedure, 110
Water samples, 51
Weekly maintenance, 59
Weight, 129
Wellness, 27
Wellness panel, 85

Y

Yearly maintenance, 59

Z

Zero position (analog out), 159
Zeroing the baseline, 146